

GIS-based indicators for the social impacts of mega urban transport projects

Varina Aurelie Delrieu

,

Bartlett School of Planning,

Faculty of the Built Environment, UCL

Thesis submitted in conformity with the requirements of Doctor of
Philosophy (PhD) in Town and Country Planning.

2012

Declaration

I, Varina Aurelie Delrieu, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

.....

Abstract

This research explores the short to long-term impacts that Mega Urban Transport Projects (MUTPs) have on the communities they serve. In particular, intentional and unintentional social impacts that occur in the communities for the non-user of the MUTP. By their very nature of being 'mega', these MUTPs act as catalysts for change at the physical, economical and socio-demographic level.

Current appraisal methods for planning and implementing MUTPs are relatively short on a standardised framework for assessing and monitoring the social impacts that communities under-go. This PhD research proposes that GIS can provide a fast and powerful overview of social patterns that can assist planners and decision-makers at local, regional and national levels to consider the 'knock-on' effects of the MUTP. This contributes towards understanding how to shape change in those communities to improve the socio-economic status for the whole population, beyond the users of the MUTP.

The research also proposes the use of the *Cynefin* decision-making model with which to assess, act and respond to these impacts and to manage the outcomes so as to amplify the positive effects and dampen the negative.

The case-studies are the two non-London hubs of the Channel Tunnel Rail Link; Ebbsfleet and Ashford, Kent. Building from the 1991 census to the most recent digital datasets the toolkit creates 'planning-to-implementation' stage profiles of the communities. Variables that are mapped include demographic diversity, socio-economic deprivation, accessibility, journey to work modes, and a pilot study to explore the impact of the MUTP upon changes in social exclusion and community cohesion.

The findings of this study conclude that whilst useful lessons can be learnt and future guidelines created for planners and decision-makers for other MUTPs, this hypothetical toolkit has weaknesses related to the lack of spatial and temporal resolution in the datasets utilised.

Keywords: GIS, social impact assessment, mega urban transport project, *Cynefin* model

GIS-based indicators for the social impacts of mega urban transport projects

Varina Delrieu

Declaration	3
Abstract	5
Table of contents	7
List of figures	11
List of acronyms	29
Acknowledgements	31
1. Introduction to the research	33
Research purpose and rationale	33
Research focus: social impact indicators	34
Research scope	35
Contribution to the field of transport planning	38
The research aim	39
Objectives	39
The research questions	39
The structure of the thesis	41
2. Literary review: MUTPs and their social impacts	44
2.1 <i>MUTPS and the social impacts of transport changes</i>	45
Access and accessibility	45
Deprivation, social exclusion and transport disadvantage	58
Sustainable mobility	66
2.2 <i>MUTPS and the social impacts of land use changes</i>	72
MUTP-led urban redevelopment and regeneration	72
Barriers: physical infrastructure of the MUTP	77
Community cohesion	81
3. Contextual background: Planning, appraisal and evaluation of transport projects in the U.K.	88
The planning framework and decision-makers	88
The transport project appraisal framework	94
Transport project evaluation and impact assessments	100

4. Information Technology in urban and transport planning	109
Tasks in planning	109
Information Technology in planning	109
How IT-based support systems could be better utilised in a planning context	112
Why IT-based systems are not fully integrated in planning practice	114
General future recommendations	116
Computing in planning and the research scope	116
5. The case-study: Subject and sample	120
The case-study MUTP: Channel Tunnel Rail Link (CTRL)	120
The main case-study hub: Ebbsfleet and Kent Thameside	121
The comparison case-study hub: Ashford	124
Impact studies of the CTRL	125
Quantitative datasets	129
6. The interpretive framework: Systems Theory	133
Systems thinking	133
The <i>Cynefin</i> framework and the CTRL case-study	135
The 'Seven Samurai of Systems Thinking'	139
The interpretative framework and research questions	144
7. The social impact indicator set:	145
Introduction to the indicators	
7.1a <i>The Demographic Profiles indicator: Methodology</i>	148
7.1b <i>The Demographic Profiles indicator: Input data and output maps</i>	151
The demographic profiles	151
The Index of Diversity	156
7.1c <i>The Demographic Profiles indicator: Findings & critical assessment</i>	159
7.2a <i>The Socio-economic Deprivation indicator: Methodology</i>	163
7.2b <i>The Socio-economic Deprivation indicator: Input data and output maps</i>	168
The Ashford indices of deprivation	169
The Ebbsfleet indices of deprivation	176
An overview of the indices: how does deprivation change?	182
7.2c <i>The Socio-economic Deprivation indicator: Findings & critical assessment</i>	185

7.3a <i>The Accessibility indicator: Methodology</i>	190
7.3b <i>The Accessibility indicator: Input data and output maps</i>	199
The Ashford accessibility measure: SmartLink	199
The Ebbsfleet accessibility measure: Fastrack	204
7.3c <i>The Accessibility indicator: Findings & critical assessment</i>	217
7.4a <i>The Physical Barriers indicator: Methodology</i>	221
7.4b <i>The Physical Barriers indicator: Input data and output maps</i>	228
The Neighbourhood Division sub-indicator	228
The Spatial Confinement sub-indicator	232
The Community Segregation sub-indicator	238
The Impeded Access sub-indicator	241
7.4c <i>The Physical Barriers indicator: Findings & critical assessment</i>	246
7.5a <i>The Journey to Work indicator: Methodology</i>	251
7.5b <i>The Journey to Work indicator: Input data and output maps</i>	256
The workplace origin-destination flows sub-indicator	256
The travel mode sub-indicator	267
7.5c <i>The Journey to Work indicator: Findings & critical assessment</i>	282
8. The Combined Score and Meta Themes indicators	286
Introduction to the indicators	
8.1a <i>The Combined Score indicator: Methodology</i>	287
8.1b <i>The Combined Score indicator: Input data and output maps</i>	291
The input datasets	291
The output: The Combined Score, a cumulative assessment	302
8.1c <i>The Combined Score indicator: Findings & critical assessment</i>	312
8.2a <i>The Meta Themes indicator: Methodology</i>	319
8.2b <i>The Meta Themes indicator: Input data and output maps</i>	326
The Community Cohesion sub-indicator	326
The Social Exclusion sub-indicator	341
8.2c <i>The Meta Themes indicator: Findings & critical assessment</i>	346
9. Conclusions and implications of the toolkit	351
Response to the main aims and objectives	351

Response to the hypotheses and research questions	356
Practical applications and implications	364
Licence agreements & copyright ownership statements and disclaimers	371
Summary of digital data sources	374
Main bibliography	375
 10. Appendix	 394
10.1 Current transport planning policy in the UK	394
10.2 The Demographic Profiles indicator	376
10.3 Ashford Index of Diversity calculations	379
10.4 Ebbsfleet Index of Diversity calculations	380
10.5 The Socio-economic Deprivation indicator	381
10.6 Modification of the SuperSegment classes	385
10.7 Ashford bus network map	388
10.8 The Accessibility indicator: Recreation and Retail opportunities	389
10.9 Accessibility to Ebbsfleet International station	393
10.10 Ebbsfleet Valley masterplan. May 2004	394
10.11 The Physical Barriers indicator: Recreation and Retail facilities	395
10.12 OD workplace flows for Ashford & Ebbsfleet most/least deprived wards	398
10.13 OD workplace flows over Google Maps	408
10.14 Calculations: Kolmogorov-Smirnov test for significance	410
10.15 Calculations: Deprivation score inputs	412
10.16 Calculations: Accessibility score	414
10.17 Scatterplot graphs for Ashford wards	416
10.18 Radar graphs for Ashford wards: all variables	418
10.19 Scatterplot graphs for Ebbsfleet	421
10.20 Radar graphs for Ebbsfleet	423
10.21 Rationale for the National Indicator Sets	425
10.22 Calculations: MSOA population turnover data for Ebbsfleet	427
10.23 Community Cohesion scores from Quality of Life indicators	428
10.24 Calculations for IMD Income Domain	429
10.25 Calculations for JSA claimants	430
10.26 CTRL questionnaire for the Pre-Hypothesis Research	430
 Appendix bibliography	 435

List of figures

Fig. No.	Caption	page
1.1	Location of the CTRL and two case study hubs	36
1.2	Data inputs for the planners' toolkit for non-user social MUTP impacts	37
1.3	A complex systems diagram to capture the impacts and influence upon the research context and outputs	38
2.1	Interaction between the input datasets (variables with a black outline form the main impact toolkit inputs)	44
2.2	Access and accessibility	46
2.3	Components of accessibility measures	47
2.4	The rate of urban process change	51
2.5	Social exclusion types	60
2.6	List of possible approaches in accessibility planning	64
3.1	The Thames Gateway development area in RPG9a	89
3.2	How the existing planning system works at local, regional and national level	91
3.3	DfT and Tavistock Transport Evaluation Guidance	102
3.4	Summary table of a variety of post-project evaluations	104
3.5	Summary of the final choice of indicator-set inputs	107
4.1	Drivers Constraints and impacts of the use of IT support systems	115
4.2	Norbert Weiner's communication model	118
5.1	CTRL phase 1 and 2: Routes through Kent	120
5.2	Kent Thameside development opportunity area	122
5.3	Now and the planned future for Ebbsfleet Valley. Thames Gateway Interim Plan	122
5.4	The urban communities around Ebbsfleet International Station	123

Fig. No.	Caption	page
5.5	Mid-2009 population estimates for communities around Ebbsfleet station	123
5.6	Ashford growth area development Masterplan 2007	124
5.7	Ebbsfleet 3km and 10km zones and 2001 Output Areas	129
5.8	Ashford 3km and 10km zones and 2001 Output Areas	130
5.9	Comparison of census units per analysis zone per case-study hub	130
5.10	Comparison of four boundary units over the same area in south London	131
5.11	Ebbsfleet 3km core wards and the number of Output Areas within	131
5.12	Ashford 3km core wards and the number of Output Areas within	132
6.1	<i>Cynefin</i> domains	136
6.2	The Seven-step process of SSM	139
6.3	The 'Seven Samurai of Systems Engineering' MUTP Impacts and the planning process	140
6.4	Double Loop learning example for MUTP impacts	143
7.1	Influences between the main toolkit indicators and the meta themes	147
7.2	Ashford OAC Group: 10km analysis zone map	151
7.3	Ashford OAC Group: 3km analysis zone map	152
7.4	Associated OAC bar charts for Ashford 10km	152
7.5	Associated OAC bar charts for Ashford 3km	152
7.6	Ashford 10km supergroup pie chart	152
7.7	Ashford OAC SuperGroup: 10km analysis zone map	153
7.8	Ebbsfleet OAC Group: 10km analysis zone map	153
7.9	Ebbsfleet OAC Group: 3km analysis zone map	154

Fig. No.	Caption	page
7.10	Associated OAC bar charts for Ebbsfleet 10km	155
7.11	Associated OAC bar charts for Ebbsfleet 3km	155
7.12	Ebbsfleet OAC SuperGroup: 10km pie chart	155
7.13	Ebbsfleet OAC SuperGroup: 10km analysis zone map	155
7.14	Ashford Index of Diversity at 2001 ward level: 2001 OAC	156
7.15	Ebbsfleet Index of Diversity at 2001 ward level: 2001 OAC	157
7.16	The extent of the Springhead Park masterplan (April 2008)	160
7.17	Domains and sub-domains in the Index of Multiple Deprivation	165
7.18	Ashford 10km analysis zone: IMD 2004	169
7.19	Ashford 10km analysis zone: IMD 2007	169
7.20	Example of rank changes classification	170
7.21	Ashford 10km analysis zone: IMD changes in ranking 2004-7	171
7.22	Box plot: Ashford IMD changes in ranking 2004-7	171
7.23	Ashford 10km analysis zone: Geographical Barrier sub-domain 2004	172
7.24	Ashford 10km analysis zone: Geographical Barrier sub-domain 2007	172
7.25	Ashford 10km analysis zone: Geographical Barrier sub-domain changes in ranking 2004-7	173
7.26	Box plot: Ashford Geographical Barrier sub-domain changes in ranking 2004-7	173
7.27	Ashford most deprived (IMD) LSOA rank changes 2004-07	174
7.28	Bar chart for the change in rankings for most deprived (IMD) LSOAs in Ashford	174
7.29	Ashford most deprived (Geographical Barriers): rank changes 2004-07	175
7.30	Bar chart for the change in rankings for most deprived (Geographical Barriers) LSOAs in Ashford	175

Fig. No.	Caption	page
7.31	Ebbsfleet 10km analysis zone: IMD 2004	176
7.32	Ebbsfleet 10km analysis zone: IMD 2007	176
7.33	Ebbsfleet 10km analysis zone: changes in relative ranking 2004-2007	177
7.34	Box plot for Ebbsfleet IMD ranks 2004-7	177
7.35	Ebbsfleet 10 km analysis zone: Geographical Barrier sub-domain 2004	178
7.36	Ebbsfleet 10 km analysis zone: Geographical Barrier sub-domain 2007	178
7.37	Ebbsfleet 10km analysis zone: Geographical Barrier sub-domain changes in ranking 2004-7	179
7.38	Box plot: Ebbsfleet Geographical Barrier sub-domain changes in ranking 2004-7	179
7.39	Ebbsfleet most deprived (IMD) LSOA rank changes 2004-07	180
7.40	Bar chart for the change in rankings for most deprived (IMD) LSOAs in Ebbsfleet	180
7.41	Ebbsfleet most deprived (Geographical Barrier) LSOA rank changes 2004-07	181
7.42	Bar chart for the change in rankings for most deprived (Geographical Barrier) LSOAs in Ebbsfleet	181
7.43	Composite bar chart: deprivation indices for Ashford	182
7.44	Composite bar chart: deprivation indices for Ebbsfleet	182
7.45	Ashford rank changes between 2004-07 for both indices	184
7.46	Ebbsfleet rank changes between 2004-07 for both indices	184
7.47	An example of changes in rankings for LSOAs	185
7.48	Percentages of LSOAs that fall, remain the same and rise in IMD sub-domain rankings for the core 3km and wider 10km analysis zones in Ashford, with the SE England GOR	186
7.49	Percentages of LSOAs that fall, remain the same and rise in Geographical Barriers sub-domain rankings for the core 3km and wider 10km analysis zones in Ashford, with the SE England GOR	186

Fig. No.	Caption	page
7.50	Percentages of LSOAs that fall, remain the same and rise in IMD sub-domain rankings for the core 3km and wider 10km analysis zones in Ebbsfleet with the SE England GOR	187
7.51	Percentages of LSOAs that fall, remain the same and rise in Geographical Barriers sub-domain rankings for the core 3km and wider 10km analysis zones in Ebbsfleet with the SE England GOR	187
7.52	Ebbsfleet 10km: Demographics and Travel to work	191
7.53	Scatterplot for Transport Need Index in England and Wales	192
7.54	Transport SuperSegment classes	193
7.55	Ebbsfleet Fastrack	194
7.56	Current bus routes through the Ebbsfleet 10km Analysis Zone	194
7.57	A workflow for a GIS-based accessibility measure	196
7.58	Ashford 3km zone: SmartLink BRT proposed route Phase 1	199
7.59	Transport Needs Index: SuperSegments classification in Ashford 3km zone	199
7.60	Vertical bar chart: Ashford 3km analysis zone SuperSegment classes	200
7.61	Ashford 3km analysis zone: Transport Needs Index	200
7.62	Ashford SmartLink bus route: TNI centroids	201
7.63	Percentages of population within each SuperSegment under 400m from the SmartLink route	201
7.64	The difference between core 3km zone and 400m bus route buffer sample populations in Ashford	202
7.65	Bar chart proportional differences between the 3km zone and bus buffer zone populations	202
7.66	Ashford SmartLink Phase 1 & 2 and Transport Needs Index at Output Area level	203
7.67	Ashford SmartLink Phase 1 & 2 and Index of Multiple Deprivation Rank change 2004-7	204
7.68	Ebbsfleet analysis zone, unemployment and Fastrack B route	204

Fig. No.	Caption	page
7.69	The communities along Fastrack route B and the 400m bus stop buffers	205
7.70	Fastrack B and unemployment at dwelling level within 400m buffers of the stops	205
7.71	Fastrack B dwellings and Output Area Classifications at Group level	206
7.72	Fastrack B Output Area Classifications at Group level and relative percentages	206
7.73	Fastrack B and the location of high level multiple occupancy	207
7.74	Fastrack B dwellings and Transport Needs Index levels	207
7.75	Bar chart: percentages of Fastrack B dwellings and Transport Needs Index levels	208
7.76	Locations of four classes of potential employment opportunities locations under 400m from a bus stop	208
7.77	Number of locations per employment opportunity class	209
7.78	Example of an OD matrix for the Fastrack B route	210
7.79	All employment locations within 400m of a bus stop on the Fastrack B route	210
7.80	Cumulative accessibility to all employment opportunities along route B	211
7.81	Accessibility measures for the Output Area Classifications: all employment opportunities	211
7.82	Breakdown of employment types per OA classification	212
7.83	'Blue Collar' employment opportunity locations along Fastrack B route	213
7.84	Accessibility for dwellings for Blue Collar employment opportunities	213
7.85	Accessibility measures for the Output Area Classifications: Blue collar opportunities (full range & mean)	214
7.86	Location of white collar employment opportunities along the Fastrack route B	214
7.87	Dwelling measures of accessibility to white collar employment opportunities	215
7.88	Accessibility measures for the Output Area Classifications: white collar opportunities (full range & mean)	215
7.89	The Ebbsfleet accessibility measure results matrix	216

Fig. No.	Caption	page
7.90	Residents defining boundaries of their perceived 'neighbourhood' in Oxford of Sheffield	223
7.91	Ebbsfleet station, line haul and 9000-place car park 2006. Looking northwards towards the Thames and Swanscombe Peninsular (Google Earth)	225
7.92	Ashford M20 pedestrian & cyclist bridge (Ashford Futures website May 2011)	225
7.93	Ashford: Physical Barriers key to 3D maps	228
7.94	Ashford barriers over the 2001 OAC Groups (west)	229
7.95	Ashford barriers over the 2001 OAC Groups (south-east)	229
7.96	Ebbsfleet: Physical Barriers key to 3D maps	230
7.97	Ebbsfleet barriers over the 2001 OAC Groups (south-east)	230
7.98	Ebbsfleet barriers over the 2001 OAC Groups (north)	231
7.99	Ebbsfleet barriers over the 2001 OAC Groups and dwelling points	231
7.100	Ashford measure of spatial confinement: confinement polygons	232
7.101	Ashford measure of spatial confinement: confined areas aperture and 2001 OAC (Groups)	233
7.102	Ashford measure of spatial confinement: confined areas aperture and 2001 OAC (Groups) (close up of the 3km zone)	233
7.103	Ashford measure of spatial confinement: confined areas and Index of Multiple Deprivation (rank changes between 2004-07, most deprived Lower Super Output Areas in the 3km zone)	234
7.104	Ashford measure of spatial confinement: Crime levels as Std. Dev. of the 10km analysis zone mean for all crimes 2007-08	234
7.105	Ebbsfleet measure of spatial confinement: confined area polygons	235
7.106	Ebbsfleet measure of spatial confinement: confined areas aperture and 2001 OAC (Groups)	236
7.107	Ebbsfleet measure of spatial confinement: confined areas and Index of Multiple Deprivation (rank changes between 2004-07, most deprived lower super output areas)	236
7.108	Ebbsfleet measure of spatial confinement and Std. Dev. of the 10km analysis zone mean for all crimes 2007-08	237

Fig. No.	Caption	page
7.109	Ashford measure of spatial confinement: confined areas, Ebbsfleet Valley development zone and dwellings (OS MasterMap Address Layer 2)	237
7.110	Communities around the proposed Ebbsfleet Valley Development	238
7.111	Ebbsfleet Master Plan (Land Securities 2007)	238
7.112	Ebbsfleet OAC group, physical barriers and the MUDP-related new development	239
7.113	Ebbsfleet IMD 2007, physical barriers and the MUDP-related new development	239
7.114	Ebbsfleet IMD rank change 2004-07, physical barriers and the MUDP-related new development	240
7.115	Ebbsfleet Valley Development, looking eastwards, Bluewater shopping centre in the lower left-hand corner. Kent County Council 2006	241
7.116	Ebbsfleet Valley Development, looking westwards, Springhead Park in the foreground. Kent Thameside 2007	241
7.117	Ebbsfleet dwellings in 1km line haul buffer and all facilities	242
7.118	Ebbsfleet line haul dwellings and nearest neighbour paths to health & education facilities	243
7.119	Ebbsfleet line haul dwellings and close up of nearest neighbour paths to health & education facilities	243
7.120	Ebbsfleet line haul dwellings and nearest neighbour paths to clinics & GP surgeries	244
7.121	Ebbsfleet dwellings and nearest neighbour paths to clinics & GP surgeries facilities	244
7.122	Ebbsfleet dwellings and nearest neighbour paths to clinics & GP surgeries facilities	245
7.123	Ebbsfleet line haul dwellings and close up of nearest neighbour paths to clinics & GP surgeries facilities with 2001 OAC	245
7.124	Ebbsfleet Axial Depth Map (radius n (global))	248
7.125	Travel modes strengths and weaknesses	251
7.126	Ashford most and least deprived wards (Carstairs Score 2001 quintiles)	256
7.127	Ashford least deprived ward example A (2001 Carstairs) journey-to-work flows	257
7.128	Ashford least deprived wards example A(2001 Carstairs) distance bands	257

Fig. No.	Caption	page
7.129	Ashford least deprived wards example B (2001 Carstairs) distance bands	257
7.130	Ashford least deprived ward example B (2001 Carstairs) journey-to-work flows	258
7.131	Ashford least deprived ward (2001 Carstairs) combined distance band graph	258
7.132	Ashford most deprived ward example A (2001 Carstairs) journey-to-work flows	259
7.133	Ashford most deprived ward example B (2001 Carstairs) journey-to-work flows	259
7.134	Ashford most deprived wards example A (2001 Carstairs) distance bands	260
7.135	Ashford most deprived wards example B (2001 Carstairs) distance bands	260
7.136	Ashford most deprived ward (2001 Carstairs) combined distance band graph	260
7.137	Ebbsfleet most and least deprived wards (Carstairs Score 2001 quintiles)	261
7.138	Ebbsfleet least deprived ward example A (2001 Carstairs) journey-to-work flows	261
7.139	Ebbsfleet least deprived ward example B (2001 Carstairs) journey-to-work flows	262
7.140	Ebbsfleet least deprived ward example A distance bands	262
7.141	Ebbsfleet least deprived ward example B distance bands	262
7.142	Ebbsfleet least deprived wards (2001 Carstairs) combined distance band graph	262
7.143	Ebbsfleet most deprived ward example A (2001 Carstairs) journey-to-work flows	263
7.144	Ebbsfleet most deprived wards example A distance bands	264
7.145	Ebbsfleet most deprived wards example B distance bands	264
7.146	Ebbsfleet most deprived ward example B (2001 Carstairs) journey-to-work flows	264
7.147	Ebbsfleet most deprived wards (2001 Carstairs) combined distance band graph	264
7.148	Ashford most & least deprived ward (2001 Carstairs) combined distance band graph	265
7.149	Cumulative distribution between most and least deprived commuter flows	265

Fig. No.	Caption	page
7.150	Ebbsfleet most & least deprived ward (2001 Carstairs) combined distance band graph	266
7.151	Cumulative distribution between most and least deprived commuter flows	266
7.152	Ashford 1991 mode data in 2001 ward definitions (all modes)	267
7.153	Ashford 1991 mode data in 2001 ward definitions (sustainable vs. car)	267
7.154	Ashford 2001 mode data in 2001 ward definitions (all modes)	268
7.155	Ashford 2001 mode data in 2001 ward definitions (sustainable vs. car)	269
7.156	Ashford 1991 mode data in 2001 CAS ward definitions (sustainable mode percentages)	269
7.157	Ashford 2001 mode data in 2001 CAS ward definitions (sustainable mode percentages)	269
7.158	Ashford percentage change between 1991 and 2001 data (sustainable mode)	270
7.159	Ashford percentage change between 1991 and 2001 data (sustainable mode)	270
7.160	Ebbsfleet 1991 mode data in 2001 ward definitions (all modes)	271
7.161	Ebbsfleet 1991 mode data in 2001 ward definitions (sustainable vs. car)	271
7.162	Ebbsfleet 2001 mode data in 2001 ward definitions (all modes)	272
7.163	Ebbsfleet 2001 mode data in 2001 ward definitions (sustainable vs. car)	272
7.164	Ebbsfleet 1991 mode data in 2001 ward definitions (sustainable mode percentages)	272
7.165	Ebbsfleet 2001 mode data in 2001 ward definitions (sustainable mode percentages)	273
7.166	Ebbsfleet percentage change between 1991 and 2001 data (sustainable mode)	273
7.167	Ebbsfleet percentage change between 1991 and 2001 data (sustainable mode)	274
7.168	Ashford modes per decade (1981 census)	274
7.169	Ashford modes per decade (1991 census)	274
7.170	Ashford modes per decade (2001 census)	275

Fig. No.	Caption	page
7.171	Trend lines for least deprived EDs / OAs in Ashford 1981-2001	275
7.172	Trend lines for most deprived EDs / OAs in Ashford 1981-2001	275
7.173	Ebbsfleet modes per decade (1981 census)	276
7.174	Ebbsfleet modes per decade (1991 census)	276
7.175	Ebbsfleet modes per decade (2001 census)	276
7.176	Trend lines for least deprived EDs / OAs in Ebbsfleet 1981-2001	277
7.177	Trend lines for most deprived EDs / OAs in Ebbsfleet 1981-2001	277
7.178	Ashford 2001 OAs: SmartLink 400m buffer and sustainable mode usage 2001	278
7.179	Ashford 2001 OAs: SmartLink 400m buffer and sustainable mode percentage change 1991-2001	279
7.180	Ebbsfleet 2001 OAs: Fastrack B 400m buffer and bus usage 2001	279
7.181	Ebbsfleet 2001 OAs: Fastrack B 400m buffer and sustainable mode percentage change 1991-2001	279
7.182	Ashford 3km zone: percentages of mode usages from 2001 census by SuperSegment typology	280
7.183	Ebbsfleet 3km analysis zone SuperSegment typology (2001 OAC)	281
7.184	Ashford 3km zone: percentages of mode usages from 2001 census by SuperSegment typology	281
8.1	Influences between the main toolkit indicators and the meta themes	286
8.2	Ashford 3km zone: Index of Diversity input map	291
8.3	Ebbsfleet 3km zone: Index of Diversity input map	292
8.4	Ashford 3km zone IMD rank changes between 2004 and 2007 input map	292
8.5	Ashford 3km zone IMD rank changes between 2004 and 2007 input map	293
8.6	Ebbsfleet 3km zone IMD rank changes between 2004 and 2007 input map	294
8.7	Ebbsfleet 3km zone geographical barrier rank changes between 2004 and 2007 input map	294

Fig. No.	Caption	page
8.8	Ashford 3km zone wards with Transport Needs Index OA centroids in the SmartLink buffer	295
8.9	Ebbsfleet 3km zone ward with all employment accessibility dwellings vs. all dwellings	295
8.10	Neighbourhood Division northern Ashford 2001 ward and 2001 OAC with linear barrier (CTRL) and passes	296
8.11	Neighbourhood Division southern Ashford 2001 ward and 2001 OAC with linear barrier (CTRL) and passes	297
8.12	Neighbourhood Division: Ebbsfleet 2001 ward and OAC with linear barriers (CTRL & North Kent) and passes	297
8.13	Ashford spatial confinement polygon aperture over 2001 wards	298
8.14	Ebbsfleet spatial confinement polygons over 2001 wards	298
8.15	Community Segregation: Ebbsfleet 2001 ward, 2001 OAC and Ebbsfleet Valley development.	299
8.16	Ebbsfleet Impeded Local Access indicator	300
8.17	Ashford 2001 wards and percentage of sustainable mode usage difference 1991-2001	301
8.18	Ebbsfleet 2001 wards and percentage of sustainable mode usage difference 1991-2001	301
8.19	Ashford Combined Score values per indicator input	302
8.20	Ashford weighted Combined Impact Score	303
8.21	Scatterplot: regressing weighted impact score against 2001 Carstairs Scores for Ashford	304
8.22	Decision-makers 'response' matrix	305
8.23	Ashford radar charts	307
8.24	Ebbsfleet Combined Score values per indicator input	308
8.25	Ebbsfleet weighted combined impact score	309
8.26	Scatterplot: regressing weighted impact score against 2001 Carstairs Scores for Ebbsfleet	310
8.27	Ebbsfleet radar charts	311
8.28	Ashford wards, from most to least deprived (Carstairs). Combined Score ranking before and after weights applied	316

Fig. No.	Caption	page
8.29	Ebbsfleet wards, from most to least deprived (Carstairs). Combined Score ranking before and after weights applied	317
8.30	The input indicators of the toolkit and meta themes of community cohesion and social exclusion	320
8.31	DfT metadata for the National Indicator NI176	324
8.32	Housing Tenure proportions in Ebbsfleet 3km analysis zone	326
8.33	Bar chart for major housing tenure types in Ebbsfleet 3km zone	327
8.34	Housing Tenure diversity index. Standard Deviations from the 3km zone mean in Ebbsfleet	327
8.35	Ebbsfleet 3km zone, average crime statistics per 2001 ward	328
8.36	Ebbsfleet 3km zone, average crime statistics per 2001 ward. Std Dev from 10km mean	328
8.37	Ebbsfleet 10km zone wards & SE GOR population changes per 1000 residents all ages mid-2008-2009	329
8.38	Ebbsfleet 3km 2001 ward boundary outlines and 2004 MSOA boundary polygons	329
8.39	Ebbsfleet 3km zone MSOA: population turnover per 1000 mid-2006-2007 (ONS)	330
8.40	Ebbsfleet 3km zone MSOA: population turnover per 1000 mid-2007-2008 (ONS)	331
8.41	Ebbsfleet 3km zone MSOA: population turnover per 1000 mid-2008-2009 (ONS)	331
8.42	Ebbsfleet MSOAs inflow, outflow and turnover (breakdown per year)	332
8.43	Ebbsfleet MSOAs inflow, outflow and turnover (3 year mean)	332
8.44	Ebbsfleet CTRL core MSOAs: population inflow, outflow & turnover for 3 years (D02)	333
8.45	Ebbsfleet CTRL core MSOAs: population inflow, outflow & turnover for 3 years (D04)	333
8.46	Ebbsfleet CTRL core MSOAs: population inflow, outflow & turnover for 3 years (G01)	333
8.47	Ebbsfleet CTRL core MSOAs: population inflow, outflow & turnover for 3 years (G06)	333
8.48	Ebbsfleet 3km zone MSOAs: scores for the standard deviation from the Kent 3 year mean	334
8.49	Ebbsfleet 3km zone OA centroids: scores for the standard deviation from the Kent 3 year mean	335

Fig. No.	Caption	page
8.50	Ebbsfleet 3km zone wards: re-aggregation of the OA centroid values: Std. Dev. from the Kent 3 year mean	335
8.51	Ebbsfleet 3km zone wards: scattergraph plot housing tenure vs. population turnover	336
8.52	The division of the Ebbsfleet wards into the higher 2001 borough council boundary definitions	336
8.53	National Indicators for Community Cohesion for Kent (NI 1)	337
8.54	National Indicators for Community Cohesion for Kent (NI 2)	337
8.55	National Indicators for Community Cohesion for Kent (NI 3)	337
8.56	National Indicators for Community Cohesion for Kent (NI 5)	338
8.57	National Indicators for Community Cohesion for Kent (NI 23)	338
8.58	Community Cohesion in Ebbsfleet- MUTP value added scores	339
8.59	Ebbsfleet 3km analysis zone: wards at risk of relatively low community cohesion	340
8.60	IMD 2007: Income Domain rank scores displayed as standard deviations from Ebbsfleet 10km mean	341
8.61	Ebbsfleet Wards, percentage of those of working age claiming Jobseekers Allowance at LSOA level	342
8.62	Ebbsfleet Wards, percentage of those claiming Jobseekers Allowance at to 2001 Ward level.	342
8.63	LSOA level number of accessible jobs via public transport or walking in under 20mins	342
8.64	Social Exclusion in Ebbsfleet- MUTP value added scores	343
8.65	Ebbsfleet 3km analysis zone: wards at risk of relatively high social exclusion	344
8.66	Scattergraph plotting community cohesion and social exclusion for Ebbsfleet wards	345
9.1	The Cynefin framework with four response domains	357
9.2	The Seven Samurai of Systems Engineering and the research context	364

Fig. No.	Caption	page
	<i>The Appendix</i>	
10.1	Counties of the SE England GOR	376
10.2	SE England GOR boundary, London boundary and the 10km analysis zones for Ebbsfleet and Ashford over Google Maps (2010)	377
10.3	SE England Government Office Region: OAC group	377
10.4	Associated OAC bar chart for SE England GOR	378
10.5	Percentage of OAs in each OAC Supergroup by region in the UK	378
10.6-7	SE England GOR: IMD 2004 & 2007	381
10.8	SE England GOR: IMD changes in ranking 2004-7	382
10.9	Box plot: SE England GOR: IMD changes in ranking 2004-7	382
10.10-11	SE England GOR: Geographical Barrier sub-domain 2004 & 2007	383
10.12	SE England GOR: Geographical Barrier sub-domain rank change 2004-7	384
10.13	Box plot for the Geographical Barrier sub-domain: SE England GOR	384
10.14-16	Overlap of TNI classes examples 1, 2 & 3	385-6
10.17	The original SuperSegment classes	386
10.18	The modified SuperSegment classes	386
10.19	Ashford bus network map April 2010	388
10.20	Location of recreational employment opportunities along the Fastrack route B	389
10.21	Dwelling measures of accessibility to recreational employment opportunities	389
10.22	Accessibility measures for the Output Area Classifications: recreational opportunities (full range & mean)	390
10.23	Multiple retail employment opportunities per spatial location on Fastrack route B	391

Fig. No.	Caption	page
10.24	Dwelling measures of accessibility to retail employment opportunities	391
10.25	Accessibility measures for the Output Area Classifications: retail opportunities (full range & mean)	392
10.26	OD matrix along Fastrack B to Ebbsfleet train station	393
10.27	Travel times from high unemployment dwellings to the station	393
10.28	Eastern Quarry masterplan. May 2004	394
10.29	Ebbsfleet line haul dwellings and nearest neighbour paths to recreational facilities	395
10.30	Ebbsfleet line haul dwellings and close up of nearest neighbour paths to recreational facilities	395
10.31	Ebbsfleet line haul dwellings and nearest neighbour paths to retail facilities	396
10.32	Ebbsfleet line haul dwellings and close up of nearest neighbour paths to retail facilities	397
10.33-35	OD workflows: Ashford least deprived wards	398
10.36-38	OD workflows: Ashford most deprived wards	399
10.39-44	OD workflows: Ebbsfleet least deprived wards	400-01
10.45-50	OD workflows: Ebbsfleet most deprived wards	402-03
10.51-53	Proportions of distances classes: Ashford least deprived	404
10.54-56	Proportions of distances classes: Ashford most deprived	405
10.5-62	Proportions of distances classes: Ebbsfleet least deprived	406
10.63-68	Proportions of distances classes: Ebbsfleet most deprived	407
10.69-70	Ashford least deprived wards: OD workplace flows over map	408
10.71-72	Ebbsfleet least deprived wards: OD workplace flows over map	409
10.73-79	Ashford scattergraphs plotting variables vs. the impact score	416-17
10.80-96	Radar graphs for Ashford 3km zone wards: all variables	418-20

Fig. No.	Caption	page
10.97-104	Ebbsfleet scattergraphs plotting variables vs. the impact score	421-22
10.105-116	Radar graphs for Ebbsfleet 3km zone wards: all variables	423-24
10.117	National Indicators (NIs) relating to Community Cohesion (CC): standard deviations	428

List of Acronyms

ABI	Area-Based Initiatives (UK Govt.)
API	Application Programming Interface
BRT	Bus Rapid Transit
CBA	Cost Benefit Analysis
CBD	Central Business District
CDC	City Development Company (UK Govt.)
CIDER	Centre for Interaction Data Estimation and Research
CTRL	Channel Tunnel Rail Link
D.C.L.G.	Dept. for Communities and Local Government (UK Govt.)
D.E.F.R.A.	Dept. for the Environment, Food and Rural Affairs (UK Govt.)
D.E.T.R.	Dept. for the Environment, Transport and the Regions (UK Govt.)
DfES	Dept. for Education and Skills (UK. Govt.)
D.F.T.	Dept. for Transport (UK Govt.)
DSS	Decision Support System
DWP	Dept. for Work and Pensions (UK Govt.)
ED	Enumeration District (census geography)
EIA	Environmental Impact Assessment
GIS	Geographical Information Systems
GIS-T	Geographical Information Systems for Transport
GP	General Practitioner, a family doctor / physician
HMR	Housing Market Renewal (UK Govt.)
HST	High-Speed Train
IMD	Index of Multiple Deprivation
IT	Information Technology
JSA	Jobseekers Allowance
LA	Local Authority
LSOA	Lower Super Output Area (census geography)
LSP	Local Strategic Partnership (UK Govt.)
LTP	Local Transport Plan
MAUP	Modifiable Areal Unit Problem
MCA	Multicriteria Analysis
MSOA	Middle Super Output Area (census geography)
MUTP	Mega Urban Transport Project
NATA	New Approach to Appraisal (UK Govt.)
NDC	New Deal for Communities
NI	National Indicator
OA	Output Area (census geography)
OD	Origin-Destination
O.D.P.M.	Office of the Deputy Prime Minister (UK Govt.)

OECD	Organisation for the Economic Cooperation and Development
ONS	Office of National Statistics
PPGIS	Public Participation Geographical Information Systems
PSS	Planning Support System
RA	Regional Assemblies (UK Govt.)
RDA	Regional Development Agency (UK Govt.)
SEU	Social Exclusion Unit (UK Govt.)
SOA	Super Output Area (census geography)
SRB	Single Regeneration Budget
Std. Dev.	Standard Deviation
T.C.P.A.	Town and Country Planning Act
UCL	University College London
URC	Urban Regeneration Company (UK Govt.)
WEB	Wider Economic Benefit
WHO	World Health Organisation

Acknowledgments

First and foremost, many thanks to Prof. Mike Batty for five years of thesis supervision and guidance, and for suggesting this studentship in the first instance. Thank you also to Prof. Harry Dimitriou for granting me the opportunity to join the OMEGA team, a Volvo Research Education Foundation-funded Centre of Excellence at the Bartlett School of Planning, for what has been a very stimulating and enjoyable experience. Encouragement, guidance and contributions were received with gratitude from all of the OMEGA team over the years; Prof. Dimitriou, Dr. John Ward, Phil Wright, Richard Oades, Rob Gallagher, June Taylor and my close friend and colleague Dr. Yen-Ning Tseng. Thank you also to Dr. Susan Batty for a final thesis revision. Finally thank you to Dr Andy Hudson-Smith at the Centre of Advanced Spatial Analysis, UCL, and Prof. Julian Hine, at the School of the Built Environment, University of Ulster for their comments and suggestions following an enjoyable viva.

I am also very grateful to the South-East England Development Agency for funding the Studentship and providing assistance in the early years regarding the context of the research. In particular I would like to mention Detlef Golletz, Egon Walesch and Ivan Perkovic. Further assistance was kindly provided by Tony Chadwick, Gravesham Borough Council Planning department, and Simon Hookway, Regeneration Manager also at Gravesham Borough Council.

I am indebted to the tireless help Annabel Brown, Bartlett Graduate Faculty Clerk, has given, and the administrative assistance and friendship provided by all the Bartlett School of Planning staff over the course of the research.

Finally, love and thanks to my husband, Greg, and my parents Colette and Martin for the endless support, especially through the difficult times, and kisses to my darling daughter, Annalise, who has had to fight for my attention in the last few months of writing up.

1.

Introduction to the research

Research purpose and rationale

This research explores the impacts that Mega Urban Transport Projects (MUTPs) have on urban communities. Of particular interest are non-user impacts of the MUTPs¹, as such infrastructure projects inevitably have complex long-term effects, both intentional and unintentional, on communities that they serve, due to the very nature of their being 'mega'. Indeed they are commonly catalysts for local and regional-level development projects. In the UK planning context, there was relatively little attention paid to the non-user impacts in any formal project appraisal frameworks, for the foci lie largely with monetised cost-benefit analyses and/or other variables in multicriteria analyses. See NATA Refresh for example (D.f.T. 2009d). These – whilst significant – do not accurately represent the spectrum of changes that occur in a real-world context.

In exploring these social non-user impacts, Geographical Information Systems (GIS) technology is utilised to map and explore potential patterns of change over the long course of the planning, construction and delivery of the MUTP, by creating a range of indicators, thereby building up a picture of social processes. It is hoped that such an indicator set could be 'bolted-on' to any GIS used by relevant decision-makers who may use it alongside other planning support systems to investigate these valuable but under-assessed issues during the planning, appraisal and evaluation of a new mega transport project. In doing so, planners would be able to identify areas where social benefits have been maximised and seeing examples of good practice, be better able to intervene where areas are experiencing multiple disbenefits.

For the purposes of this research, an MUTP is defined as costing in excess of USD\$500 million (at 1999 levels) located either within an urban area or having a significant impact on metropolitan regions. This is in keeping with the definition of the MUTP by the Omega Centre (a centre for the study of mega projects in transport and development based at the Bartlett School of Planning, UCL (Omega website 2011)), the framework within which this research is situated. For further typical characteristics of MUTPs, see Dimitriou (2008).

¹ 'Non-user impacts' are any effects experienced by the population that are not associated with using the MUTP. These are discussed in greater detail below in chapters 2, 3 and the indicator set methodology (chapter 7).

Research focus: social impact indicators

Impacts of an MUDP are wide-ranging both spatially and over long timeframes, and it has not been viable to cover them all here. The impacts chosen for exploration are in the social / socio-economic dimension such as changes in relative deprivation, demographic profiles, accessibility, neighbourhood fragmentation, spatial confinement, and travel mode and how these impact upon social exclusion and community cohesion in the MUDP urban communities. In choosing these key examples of potential social impacts, the GIS-based indicator set could enable planners and decision-makers to identify areas that would benefit from the MUDP and promote these improvements in project appraisals. Below is a brief introductory summary detailing the scope of these impact indicators.

Demographic profiles are considered due to the variation occurring in a hub following the implementation of an MUDP, both with and without associated development projects. As the populations grow and change, this can have repercussions regarding community cohesion (McPherson and Smith-Lovin 2002, Bailey and Manzi 2008).

Deprivation measures are important with regards to monitoring the changing level of multi-faceted poverty at the hubs, and relate to the lack of a resource that is needed for a basic standard of life. There are many different types of deprivation and people can be deprived of one or more of these resources, although this study explores changes in multiple deprivation and a sub-domain of the current national measures; deprivation related to geographical barriers.

Important socio-economic elements of *accessibility measures* are the ability (or inability) of various people to access opportunities, such as health and education services or retail facilities via the transport system. In an inter-urban rail scenario, access to a transport system is as significant an element as accessibility on it, and impediment to either can be a result of financial, temporal or physical costs for example. An improvement in accessibility to opportunities is often cited as a benefit to a newly implemented transport project or as a goal of related policy, such as Kent County Council's Local Transport Plan (K.C.C. 2006).

Neighbourhood fragmentation, where the MUDP infrastructure decreases social contact and recreational activities between community members, is alluded to within current multi-criteria analysis frameworks for appraising MUDPs as 'severance' (D.f.T. 2005), although their subjective and qualitative nature means that they have rarely been explicitly included in appraisals in the past (C.f.I.T. 2004).

Spatial confinement suggests that an area has been relatively more 'closed in' following the construction of the MUDP, creating a physical barrier around a defined spatial extent along with motorways, rivers, canals and other railway lines for example. This can theoretically

impact negatively upon areas of multiple entrenched deprivation, high crime and social exclusion (Vaughan 2007).

The last of the main indicators explores changes in *travel mode*, namely difference between the most and least deprived areas regarding distances travelled to work and primary transport modes used, as less long-distance commuting and a mode shift to more sustainable options is a preferable outcome of MUDP-related sustainable transport planning (Banister and Marshall 2000, Steg and Gifford 2005).

Community cohesion and social exclusion are closely related subjects but not quite antonyms. Community cohesion considers the level to which people in their neighbourhood are able to interact and take advantage of 'social' spaces. It is explored with supplementary indicators such as population turnover, demographic diversity, neighbourhood fragmentation and quality of life.

Social exclusion is seen as occurring when certain people are unable to access opportunities due to several factors; distance, time, financial cost, safety and/or the inappropriate nature of the accessible opportunities. Social exclusion often occurs in particular sectors of the populace such as the elderly or single mothers (Social Exclusion Unit 1998). As there are many facets of social exclusion, such as physical disability, or language barriers, the impact indicator focus is upon exclusion faced as a result of unemployment, and how this can be alleviated by changes following the MUDP delivery.

Research scope

The divide that often exists between academic researchers and policy makers or planners regarding approaches to evaluating data should be minimised in order for the outcomes to be useable as feedback and a basis for further transport system or land-use changes. Whilst one goal of a transport researcher could be to model travel behaviour as realistically as is viable, a balance must be struck with what is comprehensible to a wider end user-group. In 2004 a panel at the 9th World Conference on Transport Research was convened to discuss the issue of how results from transport research were to become more relevant to transport planning practice. Discussions topics included: 'In what respect is transportation research not influential?' and 'why did Professor Manheim (in whose honour the conference was held) see it as important that transportation researchers should expand their field of research to better meet the needs of policy formation and decision-making?' (Ben-Akiva and Bonsall 2004:102). The aim of the conference was to find ways in which researchers could become increasingly influential and impact more on planning policy. This had been the case in the past, where academics had delivered tools such as Traffic Management Systems. The conference outcome was:

- that researchers' work needed to be relevant to policy and management decision-making
- that researchers need to interact more often with practitioners
- there was credibility and transparency in methodology and data
- there was consistency with previous data models that were familiar, non-technical and easy to retrieve rapid responses
- and wider dissemination of research (Ben-Akiva and Bonsall 2004:105).

This research does have a technical element that utilises geo-spatial tools and techniques to explore non-user social impacts. Currently available to planners are Planning Support Systems (PSS), and Decision Support Systems (DSS) based on a range of tools able to assist in the decision-making process in urban and regional planning and development. This includes project management and resource allocation, often employing scenario-building 'what if?' approaches to explore potential outcomes and impacts of certain decisions (Geertman and Stillwell 2004). A Geographical Information System (GIS) is a spatial database system able to manage, manipulate, analyse and display data with a spatial element, and as such can be integrated into PSSs.

Taking the Channel Tunnel Rail Link (CTRL) as the case-study MUDP and its two non-London hubs, Ebbsfleet and Ashford (see fig. 1.1 below and chapter 5 for greater case-study detail), the indicator set explores the socio-economic profile of the hubs to support planners and decision-makers in all stages of the MUDP planning and delivery.



Fig. 1.1: Location of the CTRL and two case study hubs

Whilst drawing inspiration from current IT planning tools, the indicator set is neither a sophisticated modelling application, nor a decision-support system able to provide answers

to all of the questions planners and decision-makers may have. Instead it provides a context-specific indication of social issues that exist at the hubs from land use, transport and socio-economic datasets (see fig. 1.2 below). Along with a decision-management strategy, the *Cynefin* framework (Kurtz and Snowden 2003 and see chapter 6), this enables the planning and appraisal of the MUTP to ensure maximum social benefit is experienced by the whole community, not only the MUTP users. As the CTRL only commenced domestic high-speed services in 2007, the full impacts are barely being experienced let alone captured by public access digital datasets. For this reason, the indicator set as presented below, provides an example of an *ex-ante* state of the hubs from which the planners and decision-makers can devise plans that mitigate negative effects and enhance the potential positives.

The indicator set can also serve to monitor and evaluate social changes at the hubs over a long time period, and the *Cynefin* framework provides a variety of suitable approaches to manage the on-going impacts.

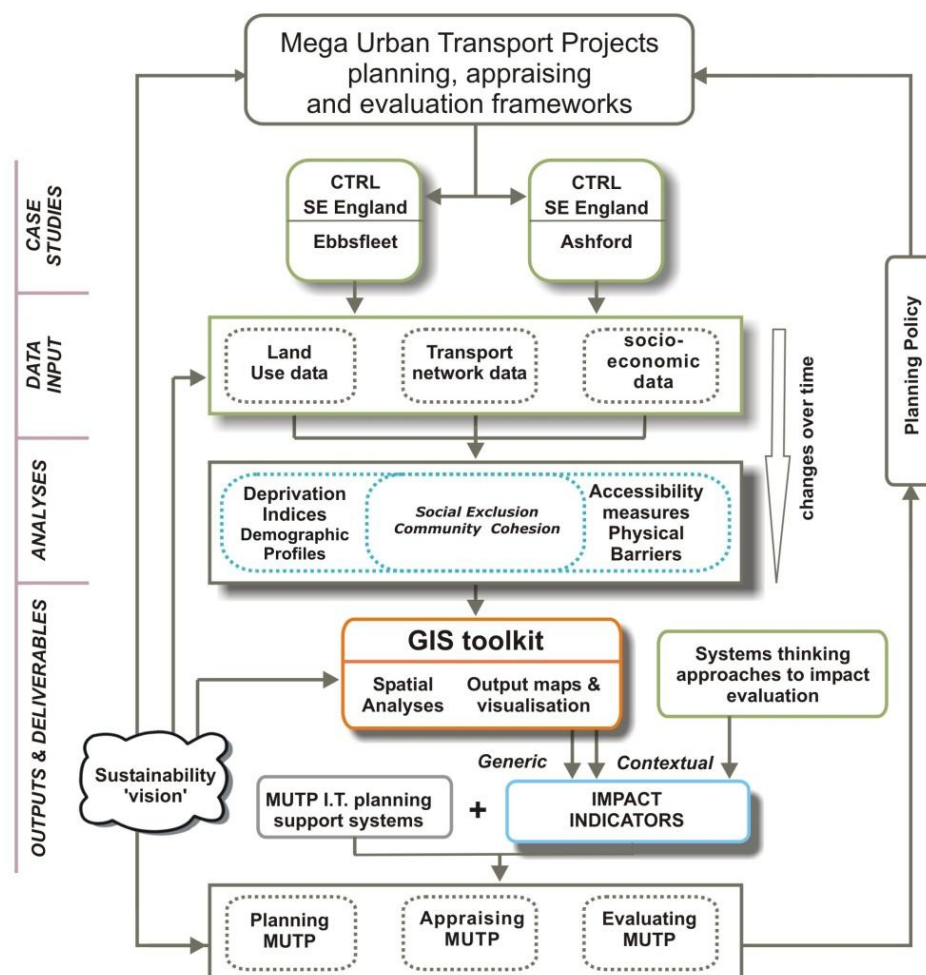


Fig 1.2: Data inputs for the planners' indicator set for non-user social MUTP impacts

In keeping with the suggestions put forward at the close of the 2004 World Conference on Transport Research mentioned above, the indicator set provides fast, flexible, straightforward and intuitive outputs about the MUTP hub populations that are communicable to all including community members. This latter group of MUTP stakeholders is particularly of interest with the advent of greater bottom-up planning through the 2010 Localism Agenda, promoting and supporting community involvement in the planning arena. This indicator set presupposes an interest in promoting social equity in light of MUTP implementation, which is currently relatively low on decision-makers' agendas when the power of local, regional and national (and sometimes international) politics and finance governs the trajectory an MUTP primarily takes (Banister and Thurstain-Goodwin 2011).

Contribution to the field of transport planning

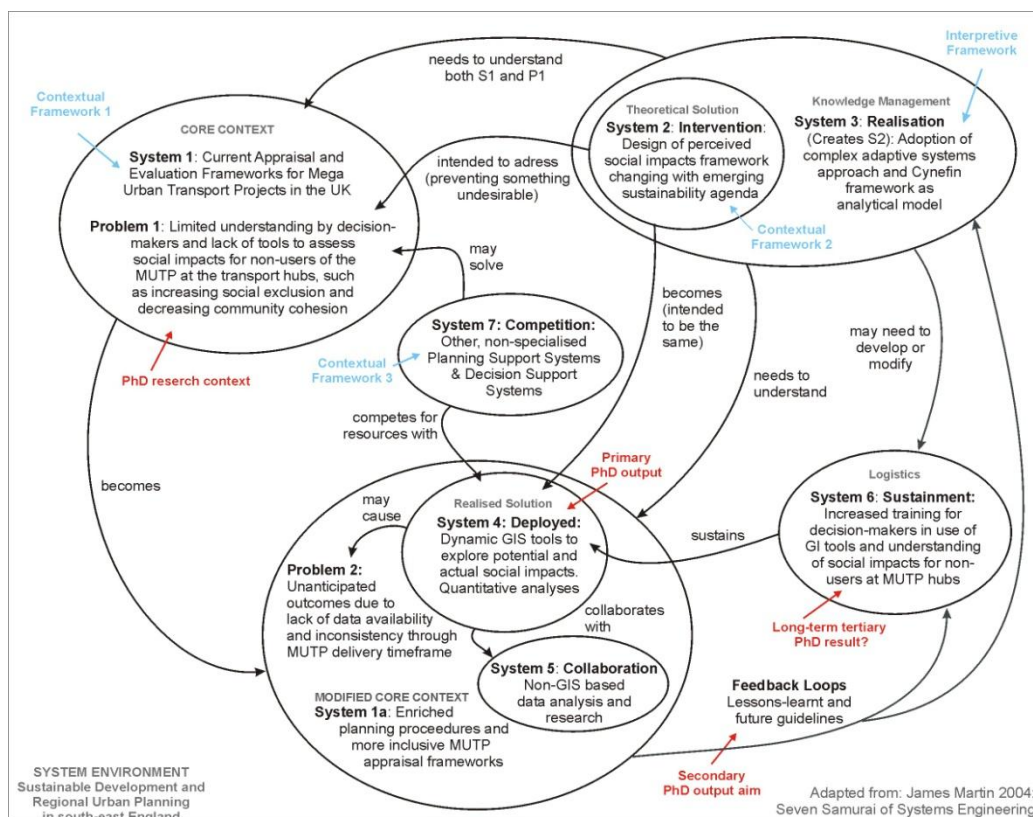


Fig 1.3: A complex systems diagram to capture the impacts and influence upon the research context and contribution to the field of major transport planning

The above systems thinking diagram (fig. 1.3) illustrates how the GIS indicator set can be of use (the approach is more fully discussed in the interpretive framework in chapter 6). In response to the core context comprising current appraisal frameworks and the absence of explicit non-user social impact exploration tools, the GIS indicator set can provide holistic and straightforward maps that can be used alongside any current PSS software, and context specific knowledge of local dynamics of which the local and regional decision-makers are aware. The creation of lesson-learned and future guidelines for decision-makers becomes viable, ensuring that good practice is established in managing a range of non-user social

impacts, repeating the most positive and planning for mitigating relatively adverse impacts in future MUTPs. Social impacts of transport projects and initiatives are discussed in the subsequent chapter followed by a detailed overview of the current planning, appraisal and evaluation processes in England. These emphasise the current absence of a framework to measure non-user social impacts that occur at the communities around a project.

The research aim

I aim to be able to derive generic and context-specific impact indicators following the creation of easy to understand and communicate maps and charts within a GIS environment. These will supplement tools such as Planning Support Systems currently available to policy-makers, planners and urban developers. A synthesis of this indicator set's output will provide a broader understanding of changes so as to play a role in the planning, appraisal and evaluation of MUTPs. This new knowledge can go towards forming guidelines and lessons-learnt for future MUTPs.

Objectives

- To identify and develop impact indicators from aggregated datasets across different contexts
- To clarify whether 'context is everything' in terms of what generic lessons for decision makers can be identified
- To contribute to the Omega Centre's key research question 'What constitutes a successful MUTP?' (Omega website 2011: research methodology) by discussion of the impacts, costs and benefits potentially derived from the case-study assessment, with particular reference to non-user impacts
- To discern what are the strengths and weaknesses in using GIS as a tool to reach the above objectives

The research questions

There are three themes running through the research questions:

- the effectiveness of presenting data in maps (via GIS) for clarifying direct social non-user impacts,
- that such impacts are detectable through widely published national datasets and subsequently context specific derived data, and
- if the datasets are effective when combined to explore more abstract indirect 'meta' impacts such as community cohesion and social exclusion.

This section deals with the impacts of the MUTP, therefore clarification is required regarding 'what is an impact'? Here there is a conceptual distinction between two types of impact as follows:

- First Order: *Direct* changes, costs or benefits to the natural / built environment and population caused by the project itself.

- Second Order: Indirect changes, costs or benefits to the natural / built environment and population, where the MUTP can be considered the most *influential catalyst* for change; i.e. outcomes attributed to first order impacts.

The first order impacts will be relatively straightforward to identify, whereas second order impacts will be more difficult to isolate and more problematic to justify, as urban communities are dynamic and evolve in many ways due to the complexity of the processes discussed in the interpretive framework, chapter 6, below. These impacts, whether direct or indirect, may range from being planned from the outset, adjoined to the project as it progressed, or unintentional, and can be considered either known with clear relationship between cause and effect, knowable with much less clear relationship between cause and effect, complex with a relationship between cause and effect very hard if not impossible to ascertain, or chaotic with no relationship between cause and effect, or oscillate between them (Kurtz and Snowden 2003).

Another Issue surrounding assessing impacts is the question of scale; geographical or temporal in the cost vs. benefit sense, i.e. an impact may only be visible in the dataset at a certain spatial resolution. What may be considered a cost at one scale could be a benefit at a different spatial or temporal scale. Discussions of how this was managed are included in the subsequent chapters as they become relevant.

Q.1: “Can a GIS-based social impact indicator approach enhance the planning, appraisal and evaluation process for MUTPs, despite the diversity and complexity of project contexts?”

This first question considers if a GIS is able to visualise such impacts given sufficient and appropriate input data. Exploration of the spatial datasets will be carried out to clarify the socio-economic profiles of the hubs with the expectation that planners and decision-makers could utilise the maps to assess the strengths and weaknesses of current community-related plans and appraisal criteria, and prepare a strategy to manage the short- and long-term impacts. The GIS datasets and techniques employed to explore them ought to be unambiguous and straightforward to communicate and replicate, for both other spatial contexts, and subsequent updating for MUTP evaluation purposes.

The research question also seeks to clarify if a GIS is a suitable tool with which to derive information from datasets that could help planners of MUTPs understand impacts better. This question suggests that while socio-economic, political and spatio-temporal ‘contexts’ are important influences regarding the way that MUTPs are planned and implemented, that there are generic anticipated outcomes and impacts at the micro (local) level and/or macro (regional to international) level. This question also implies that impacts are attributable to an MUTP either directly or indirectly, and that planners and decision-makers are aware of them and their potential implications. However a discussion regarding the spectrum of impact

processes, from simple to complicated to complex, will be a key element in responding to this question.

In responding to the question, it is also useful to identify variables, i.e. spatial phenomena, that one could expect to reliably indicate over space, time and political or cultural context as a robust or pervasive cost or benefit to the hub community. Assessing the datasets for the two CTRL hubs could reveal traits that are identifiable at both, despite the inherent differences in their demographic and spatial configurations. It is also recognised that these three elements; social, economic and physical, may well conflict with one another, such as the social cost vs. economic benefit, and are dynamic categories in themselves.

Q.2: "Can GIS-based social impact indicators provide planners and decision-makers with a better understanding of the MUTP impact on community cohesion and/or social exclusion?"

The social sustainability challenge now faced by MUTPs is an important aspect, and changes how one could consider the impact an MUTP has on the environment, both natural and social. The sustainability agenda has evolved during the CTRL's lifetime and these questions deal with elements that are believed to be more important in the government's drive to regenerate neighbourhoods (Social Exclusion Unit 1998, O.D.P.M. 2001, Tunstall and Lupton 2003). By responding to this question, we explore whether important sustainability challenges such as community cohesion and social exclusion can be derived from secondary datasets. Furthermore, are these spatially related? A cumulative indicator for these 'meta theme' processes will be created and assessed.

The second question also seeks to clarify if and how an MUTP could change the social fabric of the hub it serves to the extent that it may increase the risk of low cohesion and/or high exclusion experienced by some of the population. Alternatively the regeneration effects and other impacts of an MUTP may reduce these risks and planners and decision-makers can promote this positive impact within the project's appraisal.

The structure of the thesis

Chapter two is the literature review, detailing the potential social changes an MUTP could create. The first subsection explores the changes in transport including accessibility and the effect that has on deprivation, social exclusion and sustainable mobility. The second subsection considers the effect of land use changes following the delivery of an MUTP such as urban regeneration and development, community severance and community cohesion. This provides a substantive background for the impact indicators of the indicator set.

Chapter three describes the current government processes for planning, appraising and evaluating transport in England, such as the legislative framework, significant policies and

impact studies. This offers the contextual background of the environment within which the GIS indicator set could be of use.

Chapter four discusses the current use of IT tools such as GIS in the planning domain, how it could be better employed and what barriers exist to stop its full integration into the process, which serve to shape the approach to the indicator set's usability and outputs.

Chapter five describes the case-study MUDP, the Channel Tunnel Rail Link, the two hubs, Ebbsfleet and Ashford in Kent and four example impact assessments published on the project. There is also an introduction to the spatial and temporal boundaries of the case-study including the analysis zones and the units of measure.

Chapter six lays out the interpretive framework, where systems thinking theories are considered followed by how the processes and impacts of an MUDP can be understood through this lens. The *Cynefin* model is introduced as a decision-making strategy pertinent to how planners can respond to the social impacts of an MUDP. The Seven Samurai of Systems Engineering, a visualisation technique, is explored.

Chapter seven is the main body of the practical element of the thesis, the design and implementation of the GIS indicators with the case-study datasets. There are five sub-sections relating to the initial five main impact indicators (changes to demographic profiles, deprivation, accessibility, physical barriers and the journey to work). Each sub-section has a separate methodology, data input, map output, findings and critical assessment the indicator.

Chapter eight follows the same format as chapter seven and contains the methodology, maps and findings of the Combined Score indicator (the 'cumulative' indicator) and the 'Meta Themes', the Community Cohesion and Social Exclusion indicators.

The final chapter, the overarching conclusions, respond to the two research questions, and whether the main aims and objectives of the research have been met, if not, why. This section closes with a reiteration of the research scope, the contribution to the field of transport planning, and the study's implications and future recommendations.

Within this opening chapter the purpose and rationale of the PhD case-study scope was defined, as dictated by the research requirements of the funders, SEEDA and the wider research team at the Omega Centre. The aims, objectives and research questions expect to clarify if a GIS-based indicator approach is viable and in what context could it be of use. Also two central Omega Centre questions are posed, 'is context everything?' and 'what constitutes a successful MUDP?' which will focus the debate for the development of a range of non-user MUDP social impact indicators. The interpretive framework, the *Cynefin* model,

is briefly introduced and will form a significant element to the application of the GIS map outputs for transport appraisal and evaluations in the UK. The following chapter commences the review of the contextual background, the social impacts of MUTPs both in terms of transport infrastructure changes and land use changes.

2.

Literary review:

MUTPs and their social impacts

Given the breadth and diversity of the issues covered within the impact indicator set, only a general overview, a pertinent sample of definitions, empirical and theoretical research, government policy initiatives and critiques are provided that are relevant to the research questions.

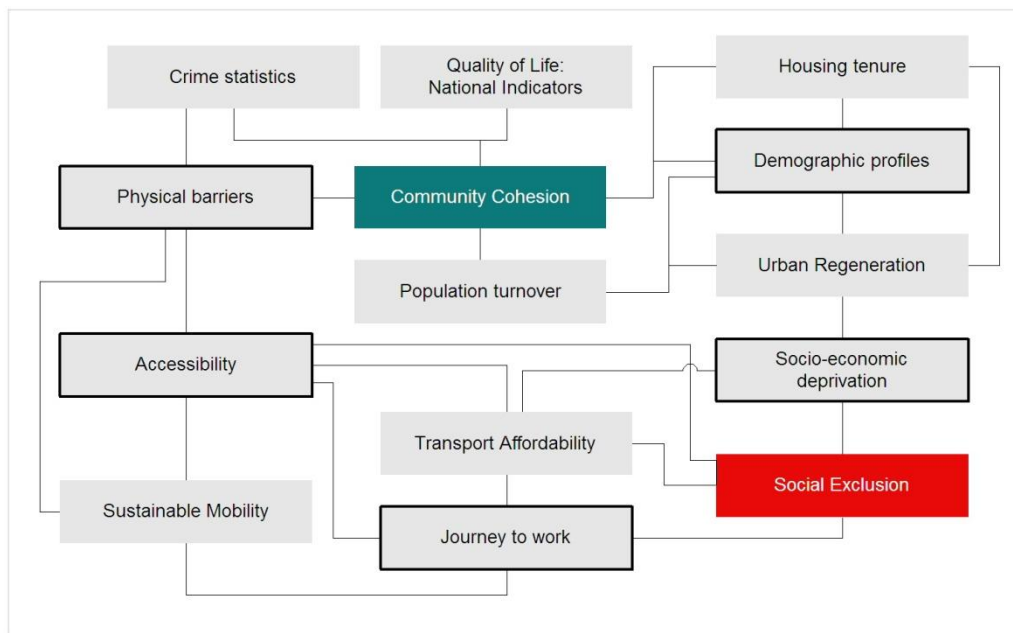


Fig 2.1: Interaction between the input datasets
(variables with a black outline form the main impact indicator set inputs)

Of the many potential input datasets for the indicator set, five main themes were chosen (depicted in fig. 2.1 above with a black outline). However there are further pertinent influences and these are also discussed within this chapter.

The initial section (2.1) reviews the literature regarding transport changes such as accessibility, deprivation and social exclusion, and sustainable mobility. The second section (2.2) considers the social impacts of changes in land use relating to Mega Urban Transport Projects, including the social impacts of the physical infrastructure, urban regeneration and development, and community cohesion. Each section includes a short discussion as to how these themes are related to the research questions, and this background information forms the basis (along with the interpretative framework) for the understanding and findings of the indicator set maps in chapters 7 and 8.

2.1

MUTPs and the social impacts of transport changes

Access and accessibility

Definitions

A plethora of definitions exist that describe the notion of inter-connectedness inherent in the study of accessibility. For example; 'the degree to which two places or points on the same surface are connected' (Harris 2001:16), or 'the measure of the capacity of a location to be reached by, or to reach different locations. Therefore, the capacity and structure of transport infrastructure are key elements in the determination of accessibility' (Rodrigue et al. 2006:28). Both the relative location and distance between two places determine their level of connectivity, hence the levels of inequality of accessibility of places under study (ibid.). Further definitions include 'the potential of opportunities for interaction' (Hansen 1959:73-76), 'the benefits provided by a transportation and land-use system' (Ben Akiva and Lerman 1985), 'the simplicity with which activities in the society can be reached including citizens, trade, industries and public services' (Makrí and Folkesson 1999:2) and 'accessibility should relate to the role of the land-use and transport systems in society, which [...] will give individuals or groups of individuals the opportunity to participate in activities in different locations' (Geurs and van Wee 2004:128). (Bruinsma and Rietveld (1998:500-501) provide a list of further alternative operationalisations of accessibility. These examples convey the sense in which accessibility measures are a mixture of spatial, social and economic elements in varying degrees. The term 'opportunities' in this context pertains to a variety of urban-based activities that people would be interested in travelling to, such as healthcare, jobs, recreation and leisure, or commerce (Guy 1981:2). Makrí (2001:4) considers six facets of social-economic and spatial accessibility:

- Physical accessibility: being able to reach a point in spite of any physical hindrances
- Mental accessibility: understanding and being able to use a given area and its facilities
- Social accessibility: having friends and a job, being able to get to and from work, meeting friends and participating in social activities
- Organisational accessibility: having access to travel opportunities, information and services regarding a journey
- Financial accessibility: being able to afford available public or private means of transport
- Virtual accessibility: being able to access information and people without moving from a certain place by using electronic facilities

These are undoubtedly significant and yet not all are overtly factored into common accessibility measures, potentially excluding what could be important influences or impediments to accessing opportunities, such as affordability or mental accessibility. Casas

(2003:110) notes that people's behaviour can impact upon their accessibility, which is in turn a result of their personality characteristics and age. This illustrates the point that two (spatial) neighbours can have different accessibility levels since there is a strong social-economic element to the issue such as financial and physical ability (Geertman and Ritsema van Eck 2004:69).

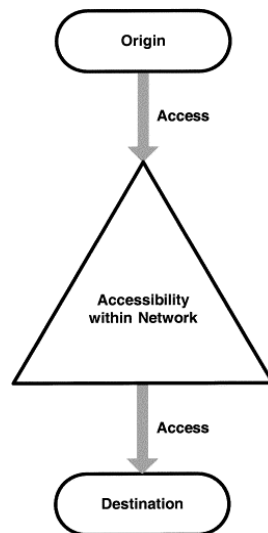


Fig. 2.2: Access and accessibility (derived from Murray et al. 2003)

There is also a distinction to be drawn between accessibility over the transport network and access to it (fig. 2.2), which is again dependent upon a complex mix of social, economic and environmental influences. It is noted in studies that increased mobility does not automatically result in better accessibility. Reasons for this include the differentiation between social groups to their usage of transport and land-use at individual levels, discussed in depth in Preston and Raje (2007).

Unintentional impacts of changes in accessibility

One potentially negative aspect of accessibility is 'excess commuting', where differences are found between empirically observed average commuting times and theoretical minimal commute times derived from migrating workers to new residences closer to their place of work in order to reduce the total commuting cost (Horner and Murray 2002:131). This is associated with improvements in accessibility that result in a reduction in time-cost of travel, which in turn naturally increase the demand in travel and congestion (Goldman and Gorham 2006). In a study examining British cities and changes in the travel time, Frost et al. (1998) provide a critique of past methodologies for exploring this issue. They find that in early studies, such as that by Small and Song (1992), excess commuting was considerable, between 70-90%, whilst with their revised methods it was found to be between 11-15% (Frost et al. 1998:530-31). Yet in their own study, Frost et al. acknowledge that they were not including the (significant) numbers of people commuting from outside a metropolitan boundary into the city (1998:523); a situation which is prevalent in London currently. These

excessive commuting statistics reflect a disjuncture from the optimum situation discussed by Levinson (1998) which noted locating employment in areas of dense housing and/or living in areas of concentrated job opportunities greatly reduced commuting time and reduced costs. When provision of a rapid transport system increases, some studies report that there is a rise in accessible areas and hence a greater scope for potential housing and employment opportunities. In tandem with this, car use can sometimes expand with the negative outcome of escalating social and spatial distances. Daily commuter travel times increase and eventually greater congestion ensues (contrary to Salomon and Mokhtarian (1998)). Travel time saved through increasing speed is often re-invested in longer distances being travelled, hence greater demands on the road infrastructure (Goldman and Gorham 2006:265, Preston and Raje 2007:156). In reaction to this, government agencies should cease promoting car use over greater areas and instead endorse the use of public transport in the denser urban areas. They need to be pro-active in guarding public transport against growing uncertainty over journey times. At the same time, improving links between the suburbs and centres to retain residents, recreation and employment at the core should occur without generating spatial or social divides with more peripheral areas (Crozet 2006:19-25).

Measuring accessibility

Accessibility can be utilised to study both travel behaviour and/or as an indicator of a transport system's performance, such as the sustainability of the system. Depending upon the research goals, several measures are available which may be more or less suitable for that purpose. In a detailed overview of accessibility perspectives and components, Geurs and van Wee (2004) define the elements that comprise the most common measures. As in fig. 2.3 below, there are four significant components:

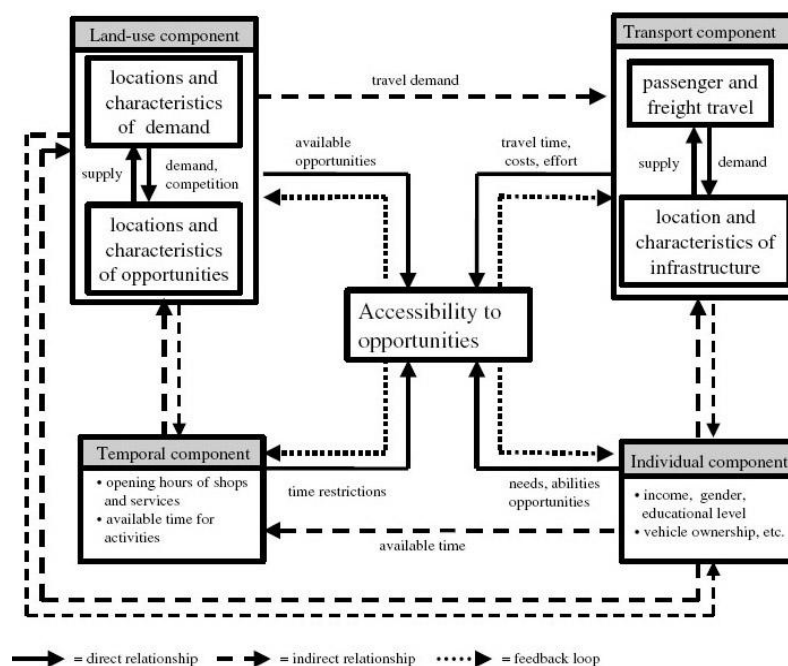


Fig 2.3: Components of accessibility measures (Geurs and van Wee 2004)

- **Transportation component:** This component describes the transportation systems in terms of the cost of travelling via a particular mode or modes of transport in order to reach one's destination. Factors that are incorporated into this component include time, either whilst travelling or waiting to travel for example, the financial cost and the effort in utilising that form of transport such as comfort, reliability or risk of accident. There is a supply element which considers the location, speed, timetable, maximum time taken, vs. the demand which can be both passenger and freight (Geurs and van Wee 2004:128). The result of such a study can be influenced by the choice of the shortest / fastest / cheapest route or a mixture of these (Van Wee et al. 2001:200)
- **Land-use component:** This component is concerned with the quantity, spatial distribution and the supply (at the destination) and demand (at the origin) of opportunities. If the capacity is naturally limited, i.e. places at a school, this results in a level of competition between people who wish to access them (Geurs and van Wee 2004:128). The effects of competition are crucial if attempting to model the local 'social markets' (Bertolini et al. 2005:218-19)
- **Temporal component:** The temporal component addresses the fluctuation in availability of certain opportunities over the course of time, either during the day or week, or more long-term such as seasonally. It also considers the time that an individual has to access and utilise an opportunity as a factor of that opportunity's accessibility (Geurs and van Wee 2004:128)
- **Individual component:** Finally, the individual component calculates the variety of factors that can influence or impede an individual's ability to access an opportunity. Indeed, a person's socio-economic class (potentially income and level of education are indicative) can be an influential factor in determining what opportunities are available. Other elements range from their age, physical ability, spatial location, travel budget, ability to drive / have access to a car, and time availability (Makrí and Folkesson 1999:3, Geurs and van Wee 2004:128)

Although these four components explore a range of realistic situations that may indicate how accessible an opportunity is (and for whom), they are not usually factored into an accessibility measure at the same time. The components are related though, providing a framework for engaging with an individual's time, effort, needs for an opportunity and the supply, spatial distribution and cost of accessing it. The four major accessibility measures have different goals and therefore different elements at their core, which explore the landscape of socio-economic accessibility in different ways with different outcomes. One cannot be said to be better than the others, but some are more comprehensive or inclusive than others and all measures have strengths and weaknesses depending on the purpose and scope of the research.

Below is a detailed explanation of the four main accessibility measure types, detailing the components used, selected applied examples, and strengths and shortcomings of employing that measure. This provides a grounding for the final choice of measure adopted in the accessibility indicator in chapter 7.3.

Transport Infrastructure-based accessibility measures

Infrastructure-based accessibility measures assess the productiveness or failure of the transport infrastructure. Indicative factors include travel times, costs (financial and effort), operating speeds, density of the network in an area (e.g. motorway kilometres per square-kilometres) or level of congestion in lost vehicles hours (Handy and Niemeier 1997:1176). Whilst analysing the transport infrastructure, modelling multi-modal travel is important in grasping the complexity of urban travel behaviour. This potentially entails collating datasets of car, bus, train, cycle and walking journeys, as getting to and from a node (such as a train station, that is access to the node) forms a significant element of understanding the accessibility. In the Netherlands, a study found that only train use showed a significant degree of multi-modal trip-chaining (i.e. several stops from home to work in order to complete auxiliary tasks such as banking or shopping) – other than walking to the bus stop or car parking place, with 33% of railway passengers biking to station, 30% walking, 22% using other public transport means, 10% in car and 5% other (Bertolini et al. 2005:210-11). This touches upon the concept of ‘access’ as well as accessibility, and considers how one gains entry to the transport infrastructure.

The use of location-allocation models (i.e. a type of optimisation model) and coverage models for public transport use commenced in the 1970s with Gleason’s model which suggested bus stop locations to maximise potential users and elevate travel time efficiency (Gleason 1975, Kwan et al. 2003:134). Murray et al. (1998:323), demonstrated that in the case of Brisbane, Australia, despite the planning goal for the city suggested that all citizens be within 400m of a tram, bus or ferry transit node, there are decreasing returns as urban becomes suburban and dispersed peripheral habitation. Indeed 83% of the population is within 3km of a transit stop, and only increases to 90% within 8.8km, hence sensitivity to urban form is needed when assessing access to infrastructure. Models that ascertain if there is redundancy in the transport system have been useful for improving efficiency and travel speeds by removing under-used bus stops as demonstrated in a study of bus transit routes by Murray & Wu (2003) who remarked that ‘access’ and ‘geographical coverage’ are conflicting notions. The higher the number of bus-stops placed along a route, the lower the geographic area covered within a travel-time budget, which could in turn result in a decrease in user demand. It is therefore necessary to design an optimised bus route with the use of location-allocation modelling. As part of the study, a limit on the distance the public is prepared to walk to the nearest bus-stop is selected as c180m in the CBD, c230m in the urban areas and around 300m in the suburbs (Murray and Wu 2003:94-95).

For public transport systems such as buses, trams, metros and (light) railways, data regarding stops, maximum capacity, routes, timetables, shelters, benches, safety and lighting would be beneficial in understanding the system as a whole (Handy and Clifton 2001:74). For those driving a car, it is suggested that by driving themselves, a greater awareness of spatial distribution of opportunities, mobility and flexibility results in higher levels of accessibility are gained (Weber and Kwan 2003:657). For pedestrians, air quality, pavement continuity, topography, visual interest, conflict points with traffic ease of road crossings were some of the factors found to be important in several evaluations (Handy and Clifton 2001:71-3). An example of research using this measure includes the UK Transport 2010 policy plan (DETR 2000) that used congestion and time lost in congestion as an accessibility measure.

Where this accessibility measure is strong is in its ability to be easily interpreted by planners and researchers, and the data from which the models are built from are usually widely available (Geurs and van Wee 2004:131). Where this measure is less successful is its non-inclusion of the other three components; land-use, temporal and individual, leaving the measure with an overly simplistic interpretation of the accessibility of an opportunity. Ignoring land-use is the most serious as it is generally agreed that potential land-use impacts following transport strategies are overlooked, such as urban sprawl following increased travel speeds. Furthermore, accessibility impacts of land-use strategies are not correctly measured beyond the indirect effects such as increased or decreased congestion, which then ignores the spatial distribution of activities (Geurs and van Wee 2004:131-2). Other problems may include the spatial and temporal resolution at which data is available, i.e. zone-to-zone travel costs and timings, but possibly not at a finer scale such as intra-neighbourhood, i.e. point-to-point, or at different times over the course of the day, week or year (Handy and Clifton 2001:74, Harris 2001:17). Harris also recommends housing-type as a significant element, but acknowledges this is sometimes hard to obtain and rarely included in transportation evaluations (2001:17).

Location-based accessibility measures

The accessibility of places is derived from patterns of land-use, such as the spatial distribution of potential travel destinations, the quality and type of opportunities located there along with an element of ease or disutility in using certain transportation modes (Handy and Niemeier 1997:1177). These measures require the use of detailed land-use maps to indicate what kind of activities exist where, but the availability and quality of such data can vary greatly between authorities (Handy and Clifton 2001:73). Of further use are socio-economic datasets detailing age, ethnicity, income, gender, family size and employment of the residents (Harris 2001:17). It is noted by Straatemeier (2006:15) that the knock-on effects on land-use of a large transport project may take time to proliferate, for example the Amsterdam

orbital motorway was completed in 1992, but the repercussion are still on-going. Shaw and Xin (2003:103) agree that changes can occur in the long-term especially regarding land-use, and short-term changes occur as people and companies and institutions are faster to adapt to new transportation systems. They remark that reactions to infrastructure alterations are happening at many different spatio-temporal scales, and this is described in the following table (fig. 2.4) from Wegener and Furst (1999:43)

Urban Change Process	Examples
Very slow change	Networks (e.g. transportation networks, communications networks): are the most permanent elements of cities Land-Use: distribution is often stable, changes are incremental
Slow Change	Work-places (e.g. warehouses, office buildings, shopping centres): exists much longer than the firms or institutions that occupy them Housing: exists longer than the households that live in it
Fast Change	Employment: refers to firms that open, close, expand or relocate Population: refers to households that form, grow, decline, dissolve or relocate
Immediate Change	Goods transport: adjusts quickly to changes in demand Travel: adjusts quickly to changes in traffic conditions

Fig.2.4: The rate of urban process change (derived from Wegener and Furst 1999)

Below are four different measures in order of increased travel behavioural consistency matched with the complexity of interpretation of the results:

- Distance

This measure is useful in large-scale analyses of urban landscapes with a heavy spatial element, and is usually considered the simplest location-based measure. Exploring the accessibility of two points (origin and opportunity location) within a radius and taking an average distance measured is commonly the form the measure will take. Maximum travel time or distance between the two points, or transport infrastructure, sometimes incorporates the effects of competition (Makrí and Folkesson 1999, Geurs and van Wee 2004:129). An example of this measure in urban planning and urban geography is due to Ingram (1971), which is an early effort towards the operationalisation of relative accessibility. Its biggest strength lies with its simplicity, in measuring and calculation, and it is straightforward to interpret and communicate (Bruinsma and Rietveld 1998:504). As for weaknesses, In their study, Weber and Kwan (2003:647-8), urge caution when assuming that there is a linear relationship between decreasing distance from opportunities (such as a Central Business District) and increases in accessibility. Indeed, distance may be a fairly low-priority when balanced against other factors which influence location of residence such as race, income and occupation or personal preference for a more distant alternative opportunity (Kwan et al.

2003:132). Furthermore, this measure is overly sensitive to the size of the study area, too narrow where a boundary definition and some opportunities are ignored, and too broad and the outliers become overly influential (Bruinsma and Rietveld 1998:504).

- Contour or cumulative opportunities

When there are more than two points in the origin-destination, this isochrone measure counts the potential number of opportunities available within certain parameters such as distance, time or cost, with a weighting scheme for opportunities which are relatively further away or harder to access (Guy 1981:4-5, Handy and Clifton 2001). One of the key issues when calibrating the model is selecting an arbitrary but meaningful limitation to the travel costs or time, considering that 'time taken to travel' will be subject to differences in mode and the time of day. In a case-study based in the Netherlands, 30 minutes commuting time was considered sufficient, based on empirical commuting data, other international studies and the perception that this time limit has resonance with the functions of urban areas in Europe (Bertolini et al. 2005:210-11). Indeed the 30 minute mark is believed to be a global phenomena in existence for six centuries (Kenworthy and Laube 1999:703). Using contour lines to delimit road charges or parking costs is also viable (Bertolini et al. 2005:219). In this measure the attractiveness of a destination can be considered a function of the number of opportunities available (Liu and Zhu 2004:107). In one accessibility study that utilises contour lines, Gutierrez & Urbano (1996) created maps of changes in accessibility for trans-European road networks. The isolines show the accessibility between 94 urban agglomerations in 1992 and 2002, and demonstrate the greatest changes in accessibility take place in the geographically peripheral regions such as the UK, Greece and some Mediterranean islands (Gutiérrez and Urbano 1996:20-22). Further examples are presented by Wickstrom (1971), Guy (1981), and Bruinsma and Rietveld (1998). This measure benefits from being simple in gathering data and interpreting the results of the model and communicating them to planners. It makes no assumptions regarding individuals' perceptions regarding land-use, transportation or their interaction. (Handy and Clifton 2001:69, Bertolini et al. 2005:219).

The short-comings relate to the land-use and transport components being only considered individually, but with their combined effects ignored (Bertolini et al. 2005:210-11). Also the effects of competition for access to limited capacity opportunities are not factored in (Geurs and van Wee 2004:133). There is no any differentiation in the desirability of the opportunity; all opportunities are regarded at a uniform level of attractiveness without a distance decay function and hence fail to explore social and economic differentiation (Vickerman 1974, Ben-Akiva and Lerman 1979, Harris 2001:18, Geurs and van Wee 2004:133). Furthermore once a cut-off for travel time or cost has been chosen, the contour line that delimits this value becomes a sharp, unnatural border between opportunities found within and beyond it in the model. In reality there is a continuous gradient, where people may be more flexible about

travel cost and distance, travelling further or for higher costs for more attractive opportunities (Bertolini et al. 2005:218-19). Finally most measures assume a home-based origin which ignores common multi-purpose trips or trip-chaining where secondary (or more remote), destinations may present different travel behaviour choices not accounted for (Casas 2003:115).

- Potential accessibility / gravity-based measures

Gravity-based measures assess the potential accessibility (A_{ij}) of all opportunities within one zone (i) from other zones (j) under study, within which there is a diminishing scale of attractiveness i.e. a distance decay function, for opportunities which are smaller or further away, i.e. with greater travel impedance (Song 1996:477, Harris 2001:18). Originally derived from an analogy of Newton's laws of motion, they initially utilised the inverse square of distance, then later the general negative power of distance, but more commonly now employ a negative exponential function (Harris 2001:18). Most measures assume a negative exponential cost / impedance function as it is believed to be more closely associated with patterns of travel behaviour theory than the power, Gaussian or logistic functions (Handy and Niemeier 1997:1179, Geurs and van Wee 2004:133). Also the cost sensitivity parameter conveys a significant influence on the outcome of the measure and therefore study of the empirical data must be used to better inform the choice of the parameter (Geurs and van Wee 2004:134). This type of measure has been employed in several studies; see Hansen (1959), Ingram (1971) and Vickerman (1974). As there is an emphasis on zoning, this can facilitate the distinction between different socio-economic groups and hence offer a more informed level of access for these groups (Geurs and van Wee 2004:134).

On the negative side, fairly detailed information about travel behaviour is required for a model to have realistic parameters (Guy 1981:6-7). Also the output from this measure can be difficult to interpret due to the complexity of combining land-use and transport elements, along with the cost sensitivity function which usually includes a weighting scheme for opportunities (Geertman and Ritsema van Eck 1995:70). Furthermore, the effects of competition for opportunities and time constraints are not factored in (Handy and Clifton 2001:69, Geurs and van Wee 2004:134). Finally, Ingram (1971:6) and Guy (1981:104) suggest accessibility measures close to the origin can model unrealistic behaviour as some gravity-based models have a tendency for too-rapid decay close to the origin when compared to empirical observations. Ingram proposes instead a modified Gaussian function that declines gradually at first, increasingly more steeply with increased distance from origin. In several inter-urban rail impact studies (Gutierrez et al. 1996, Gutiérrez 2001, Chang and Lee 2007), this (or a core section) has been the measure of choice as it has a solid theoretical background and a flexible, communicable framework, although its use of aggregate data can be a drawback if one wishes to include detailed commuter data (Chang and Lee 2007:93-96).

- Adapted Potential accessibility measure

Working within the framework of gravity-based measures (above), efforts have been made to include the effects of competition in this model (Geurs and Ritsema Van Eck 2003). There are three key adaptations of the gravity measure:

i) When distances between the origin and destination are small, one measure divides the number of opportunities 'within reach' from the origin zone, i.e. the potential supply, by the potential demand from the same zone (Weibull 1976, Knox 1978). Van Wee et al. (2001) created a new measure in their study to illustrate why instead of locating in the centre of a town (i.e. the CBD), it would be better for companies to be geographically spread about in terms of competing for potential employees (Van Wee et al. 2001:201). They demonstrate that change in accessibility of up to 10% or more is possible, but remark that this 10% may mean relatively little in the real world as most potential employees would prefer not to move home too often and other factors including time and financial cost would preclude them from maximising their opportunities if they did not move (Van Wee et al. 2001:207).

ii) For examples when there is competition for limited capacity opportunities (e.g.: hospital beds), the quotient of opportunities 'within reach' from the origin i (i.e. the potential supply) is used verses the potential demand for those opportunities from each destination j . This model is entitled 'doubly-constrained potential model' (Shen 1998:133). Further examples are presented in Breheny (1978) and Joseph and Bantock (1982). Shen's accessibility model is employed by Kwok and Yeh (2004:924) when exploring the accessibility gap between low-energy and high-energy efficient modes of transportation in Hong Kong. They endorse the use of this measure on the grounds that aside from the reality of the limited capacity of many opportunities, the population base is not evenly distributed across space and hence some opportunities are more in demand than others.

iii) The third approach appropriates Wilson's doubly-constrained spatial interaction model's 'balancing factors' (Wilson 1970) and is useful for modelling the effects of competition when it is applicable at both the origin and destination (for example job accessibility where workers and employers and in competition with one another). Here the balancing factor constrains the flow of trips from zone i (the example origin) to zone j so that it is equal to the number of workers (in this example) at zone i , to jobs in zone j .

As the balancing factors are mutually dependent (Geurs and van Wee 2004:134), they must be estimated by an iterative process, which is also a significant flaw in its usability and associated complexity of understanding the results. Symmetry in supply and demand is controlled in this instance, but in many cases, asymmetry exists, but is not always considered and modelled by other measures (Harris 2001:22).

Person-based accessibility measures

This measure is rooted in the concept of space-time geography (Hägerstrand 1970). Where accessibility of places entails assessing the ease with which particular places can be

reached, individual accessibility measures attempt to identify a person's ability to travel around their environment towards particular locations within a range of constraints such as time and space (Weber and Kwan 2003:648). Some consideration needs to be made in the factors that influence the attractiveness (or repulsion i.e. a school with a poor reputation) of certain opportunities to a person. Some elements are fairly straightforward; for example, when evaluating shopping centres, the size of the shop, size of car-parking, proximity to other shops or price of consumer goods are likely to be important. Others are more subjective in their influence on an individual's behaviour and hence difficult to factor in, and can include facilities such as toilets and children's areas, how busy the shop is, length of queues at the tills or quality of the goods (Makrí and Folkesson 1999:3, Handy and Clifton 2001:70). The inclusion of temporal constraints is important in this measure, as opportunities are not always available and a reflection of that is a reduction in accessibility for that opportunity and subsequently, the spatio-temporal 'shape' of its accessibility (Kwan et al. 2003:131). This is also known as a 'space-time prism' i.e. a map which determines the "feasible set of locations for travel and activity participation in a bounded expanse of space and a limited interval of time" (Miller 1991:289). The degree of the prism's slope alters with the speed at which the transportation system permits movement through that space (O'Sullivan et al. 2000:87). Temporal impedance is also transport mode specific, so care must be made when including this element as time spent travelling is of significant influence in an individual's choice of mode (Handy and Clifton 2001:71). Weber and Kwan (2003:649-61) conducted a study which sought to assess and isolate the effects of geographical context upon individual accessibility, incorporating the complexity of a person's daily movements and spatio-temporal restrictions which are partially directed by age, class, and race for example. In their car-only study based in Portland (Oregon, U.S.), the authors employed multiple regression (and extended it to multi-level modelling) to draw-out important socio-economic characteristics of a person's household, producing some interesting and unexpected results. Counter to neo-traditional thinking, they find homes in lower-density areas have better accessibility, and furthermore, increased accessibility was not indexed to increase in income, housing age or population density but instead, accessibility was most closely tied to the individual's place of work, followed by household size and number of hours worked. This is a good example of how variables cannot be assumed to act as proxies for each other. High-density and accessibility are often thought to be closely interrelated but here other confounding effects proved otherwise (Harris 2001:30). In another study (utilising the same dataset) that aimed to explore the potential of activity based modelling, Recker et al. (2001:341) evaluate the role of trip-chaining and ride-sharing as a way of meeting transport policy objectives effectively. They found that overall there was a strong correlation between the size of the household, the complexity of activity patterns and hence greater opportunities to improve efficiency through trip-chaining and ride sharing (Recker et al. 2001:351). This time saving is acknowledged though, to be too minor to be translated into sufficient time to

do anything substantial outside of the house for most people with average activity times (Recker et al. 2001:357).

As a strength, it is considered to be superior to 'place' or locational accessibility measures in several respects. By considering an individual's experience, there are many benefits to using this measure such as the ability to consider the effects of gender, age or class. It offers a more focused social evaluation of land-use or transport changes, and does not presume that every person located in a zone has similar needs or abilities, i.e. avoiding the risk of 'ecological fallacy' (Makrí and Folkesson 1999:7, Kwan et al. 2003:130). Being able to disaggregate the sample population by social and economic class bears a significant impact on the attractiveness or 'pull' of certain opportunities, although finding data that elucidate such classification, such as detailed employment data at a suitable spatial (and temporal) resolution, can be hard to come by (Handy and Clifton 2001:73).

However, there are several weaknesses in this measure. For example, there is no incorporation of the effects of competition, the raw field data is hard to compile (entailing complex datasets of completed daily activities from a number of people), the computational processing intensive, and the results are usually too context specific to appropriate elsewhere (Makrí and Folkesson 1999:8). This is supported in the study conducted by Recker et al (2001), where the authors note that whilst the model is successful at manipulating and calculating complex simulations - as is commonplace in a person's activity travel through space-time - the computational strain of dealing with such a vast array of constraints and variables means as a tool, it can be difficult to compute large-scale problems (Recker et al. 2001:347). The authors attempted to overcome this with a solution which applied dynamic programming methods, but could not surmount the issue of making rigid assumptions about behaviour which would need to be relaxed for more realistic scenarios (Recker et al. 2001:360). Also, most evaluation studies will have a centroid, which is presumed to be the centre of daily (often uni-modal and single purpose) activities for an individual, and is often the home, which, in many cases, is not the hub of daily activities (Weber and Kwan 2003:648). Ettema and Timmermans (2007) isolate four further issues with space-time accessibility, namely the ability of individuals to adjust their activity-travel patterns in coping with constrained choice sets, uncertainty in the perception of travel times, temporal variability of travel times, and the influence of travel information on accessibility. They seek to remedy these shortcomings with a variety of solutions (Ettema and Timmermans 2007).

Utility-based accessibility measures

In considering the potential transportation choices one could make from the range on offer, which all essentially attain the same goal, utility theory models travel behaviour and the net benefits gained by a variety of users of a transport system. There are two variations of this

measure used. Based on random utility theory, the probability of an individual making a specific transportation choice depends on the net utility of that choice in relation to the utility of all choices; the accessibility measure is the denominator of the multi-nomial logit model, sometimes referred to as the logsum, and reflects the total utility of all choices. It is assumed that individuals would seek to maximise their utility. (Handy and Niemeier 1997:1177, Handy and Clifton 2001:69), and see Ben-Akiva & Lerman (1985) for an early utilisation of this type of measure. Using the doubly-constrained entropy model Martínez and Araya (2000) consider the hypothesis that it is possible to establish a direct association between trips and benefits induced by a transport project. Seen as being of particular benefit, the measure can integrate the separate and combined effects of changes to land-use and/or transport, along with the emphasis on the financial user-benefits of transport choices. Hence this measure is highly useful for economic evaluations. (Geurs and van Wee 2004:136). Another advantage rests with the ability to test alternative formulations of the function for one that reflects known travel behaviour. The relative importance of input factors can be handled by the calibration of the model and need not be pre-determined as in gravity-based models (Makrí and Folkesson 1999:7). Horner (2004:267) cites the ability to minimally conserve the number of potential workers and employment opportunities in a specified area when analysing travel to work between locations as being highly useful in planning practice. Martínez and Araya (2000:794) use this measure in their research as they believe it to be a sound method for appraising transport projects, for example as a tool that could calculate a net benefit for each specific project.

Shortcomings include the issue that there is often no temporal element included in these measures, and their output is difficult to understand and communicate (Handy and Clifton 2001:69. Koenig 1980). In their study Martínez and Araya (2000:794) remarked that aggregated household-side benefits assume that all members value these benefits equally, which may not be the case in reality. Miller (1999) has researched the potential of combining utility-based and individual-based measures and whilst this could lead to more individual level assessment in economic evaluations, there is too little long-term individual activity data available to be of pragmatic use (Geurs and van Wee 2004:135-6). Lastly, the large number of potential choice alternatives can make computation costly (Ben-Akiva and Lerman 1979:677) although this is an increasingly diminishing problem with the use of super-computing.

When selecting which measure to adopt for a study, three elements are important to consider:

- The aim of the evaluation: to capture the dynamic interplay between transport (mode / distances), land-use (spatial distribution of opportunities) and the attributes of the sample population (Geurs and van Wee 2004:130) as far as practicable given the subsequent factors

- The availability and/or quality of the datasets: Being able to collate a large and sufficiently representative sample of the population over a significant amount of time will often limit what can realistically be achieved within the time and budget of a study (Handy and Niemeier 1997:1178). However care must be given when utilising aggregated datasets, particularly in relation to the Modifiable Areal Unit Problem and ecological fallacy pitfalls (see chapter 7) (Fotheringham and Wong 1991:1025-44, Hewko et al. 2002, Horner and Murray 2002:133-35)
- Interpretability and communicability to the user-group: The divide regarding approaches to evaluating data that often exists between academic researchers and policy makers or planners should be minimised in order for the outcomes to be useable as feedback and as a basis for further transport system or land-use changes (Ben-Akiva and Bonsall 2004:102).

Accessibility and the research scope

In ascertaining the impacts of the MUTP upon the case-study hubs, accessibility is a significant element of change for the MUTP users (the international and domestic high-speed services) as well as the subsequent amendments to the local transport network. Accessibility is also a variable in the policy initiatives of the national government to reduce deprivation through social exclusion, discussed in detail below. Hence two Accessibility Indicator measures are carried out for the hubs to explore the social equity of the MUTP-related 'feeder' services. Furthermore, the Impeded Access sub-indicator considers restrictions in access following community severance (discussed in more detail in section 2.2 below). Given the wide range of accessibility questions the different measures described above respond too, in exploring Ebbsfleet's feeder service, the indicator adopts a modified gravity-based accessibility measure, a type of location-based measure (described in detail in chapter 7.3a).

Deprivation, social exclusion and transport disadvantage

This section discusses how changes in accessibility can have a positive impact upon a population and how transport disadvantage, for example low accessibility, access or mobility, can exacerbate deprivation and/or social exclusion.

History of social exclusion

The pioneering work of Seebohm Rowntree on 'pauperism' in the early 20th century drew attention to the influences of economic circumstance that kept some of the population in absolute poverty. His research prompted early welfare policies including the Old Age Pension Act (1908) and the National Insurance Act (1911) enacted by Lloyd George, the then Chancellor (Rowntree Society 2011). French social scientists René Lenoir and Henri Lefebvre are considered the originators of the concepts of 'social exclusion' from their work in the mid-1970s (Lefebvre 1974, Lenoir 1974). The term 'social exclusion' was not part of

the UK Governmental vernacular until the mid-1990s. Beforehand, during the 1980s and most of the 90s when Conservative Neo-Liberalism dominated national government policy, expressions such as 'underclass' existed when referring to the deprived section of the populace. Under this political paradigm, poverty and inequality were viewed as a product of the market-led economy (Anderson 2000:8). The Social Exclusion Unit, which was in operation from 1997 to 2006 (and disbanded and reformed as a Taskforce until November 2010), targeted poverty prevention and social exclusion through government-led programmes. The Unit remarked in 1998 that 4,000 neighbourhoods were pockets of intense deprivation, with problems of crime and unemployment tied strongly to poor health, housing and education (Social Exclusion Unit 1998:9). It is only since circa 2000 that the social cost of accessibility or rather inaccessibility has been considered seriously in the appraisal of transportation projects in the UK (Social Exclusion Unit 2003:8). The Dept. for the Environment, Transport and the Regions (DETR, preceding the Dept. for Transport) recognised that there were shortcomings in modelling the concept of social exclusion in current policy studies. They noted that the Index of Multiple Deprivation did not attribute any weight to the influence of transport policy when assessing social exclusion (Church et al. 2000:200). In the early 21st century, the pace increased in exploring, assessing and producing initiatives to understand how transport impacted on people in multi-faceted ways, yet the social aspect was often viewed as subsidiary to economic and environmental elements of sustainable mobility (Preston 2009:140).

Definitions of social exclusion

Social exclusion is a many faceted phenomenon (both a process and an end state), with many sections in the general population potentially excluded to varying extents. Several definitions exist, one early example by the Centre for the Analysis of Social Exclusion (CASE, LSE 1999):

“An individual is socially excluded if a) he/she is a geographical resident in a society, but b) for reasons beyond his/her control he/she cannot participate in the normal activities of citizens in that society and c) he/she would like to participate” (Barry 2002:14-15).

Barry continues that there are some notable elements to this definition that try to clarify the complex issues surrounding social exclusion, namely that some people will chose to voluntarily exclude themselves from the wider society, which might be considered to lead to social fragmentation. Indeed group social isolation could initially be by choice but may eventually lead to an inability to participate for a number of reasons, but furthermore reject attempts to reintegrate them. For example, where exclusion from social activities is forced upon an individual due to race, gender or religious reasons, even when there is no desire to take part in such activities (Barry 2002:14-16). Preston and Raje offer a further working definition as

“Social exclusion is a constraints-based process, which causes individuals or groups not to participate in normal activities in society in which they are residents and has important spatial manifestations” (2007:151)

Main Classification:	Groups:
Addicts / abusers	Addicts and substance abusers
Communities/ social capital	Isolated (lonely)
Crime	Offenders, victims of crime, youth offenders
Discrimination/ migration	Ethnic and cultural minorities, lesbian, gay, bisexual, non-English speakers, refugees and asylum seekers
Education	Early school leavers, illiterate (innumerate), truants
Employment	Unemployed
Health	Disabled, poor health
Housing	Frequent movers, homeless
Income / Poverty	Low income households, people on benefit
Parents, Families and Carers	Carers, problem families, single parents
Miscellaneous	Children at risk, older people, rural deprived, young disadvantaged

Fig. 2.5: Social exclusion types

Levitas et al. (2007) produced a matrix for inputs and influences for social exclusion for the Social Exclusion Taskforce, which includes ten domains of exclusion in three sub-groups. These were resources (e.g. material and social), participation (e.g. culture and political), and quality of life (e.g. health and living environment).

Social exclusion can be linked to transport-related accessibility through:

Spatial-related exclusion:

- Physical exclusion: based on physical, cognitive or linguistic barriers.
- Space exclusion: based on inappropriate design of transport interchanges and related public spaces.
- Exclusion from facilities: based on the location and/or nature of the facilities themselves.
- Geographical exclusion: based on shortcomings in spatial coverage of transport provision. (Church et al. 2000)

Thinking of distance as a factor to being able to access opportunities is discussed above in accessibility measures such as cumulative or gravity-based approaches. Examining this from a social perspective, those who are unable to travel that far experience relative inaccessibility, and this usually includes the elderly, the frail, and those with some physical disability. For example, for someone with restricted mobility, walking 10 minutes or more to a bus stop might be hard and could exclude the person from accessing a service. This occurs not just at the personal level, but whole areas on the periphery of an urban community may be relatively excluded due to a general lack of transport provision. This is seen if there is a low level of car-ownership, particularly prevalent in areas of economic deprivation and especially for women (Hine and Mitchell 2001: 2-3). Those without cars have to rely on public transport, walking or cycling that can be expensive, inadequate and/or unpleasant, in terms of noise, traffic volume and pollution (Pennycook et al. 2001:4).

Cost-based exclusion (i.e. affordability):

- Economic exclusion: based on the cost of transport services.
- Time-based exclusion: based in scheduling conflicts and incompatibilities between the schedules of transport services (Church et al. 2000)

Cost can be both financial and temporal. For example, there is a strong correlation with higher household income and car ownership. Those without access to a car tend to pay a higher cost (in terms of proportion of their income and longer trip-times) to access the same range of opportunities via public transport as those with a car (Hine and Mitchell 2001:3-5). This can vary over time and space, hence some spatially peripheral areas may have a particularly low accessibility to opportunities in the evening or at the weekends due to restricted bus services for example. Preston and Raje note that bus companies in the UK are privately owned and beyond local authority control, and therefore there will not be any inclination to offer unprofitable routes to those areas suffering from low-accessibility, especially at affordable fares (Preston and Raje 2007:159). However as Lucas notes in her study of accessibility planning, fare data are hard to procure, with many transport authorities reluctant to disclose this information for reasons that remain unclear. This made ascertaining the affordability of public transport hard to quantify (Lucas 2006:805).

Safety-based exclusion

- Fear-based exclusion: based on concerns regarding personal safety and security associated with the use of transport services (Church et al. 2000).

This highly subjective aspect would be hard to map or analyse but it is not uncommon for those people most vulnerable to social exclusion to feel unable to access certain opportunities, as the journey may be (perceived to be) dangerous and risky. This increases at night time and can be linked to urban form as well as transport provision. Again, car-ownership would often mitigate against this in areas of higher household income, and hence this is most prevalent amongst those of lower socio-economic status. In their study of Scottish transport provision and social exclusion, Hine and Mitchell (2001) found that 44% of respondents to their survey felt that their use of public transport was curtailed by concerns about personal safety (compared to 30% citing poor routing, and 19% due to costs).

The work of economist and philosopher Amartya Sen (1985, 1987) provided ideas for expanding exclusion definitions to include notions of individual capabilities and needs. Stanley and Vella-Broderick continue this theme by promoting elements of well-being and personal interactions as further potential variables for defining exclusion (2009). In their concluding remarks, Hine and Mitchell emphasise that despite transport disadvantage experienced by some considered excluded, transport-related issues were not always the sole or primary reason for exclusion (Hine and Mitchell 2001:6). See Lyons (2003) and Miller (2003) for further support for the relationship between exclusion and transport disadvantage.

Severance between areas due to large transport infrastructure (i.e.: a motorway or railway line) can impede access, restricting movement by walking and cycling and causing trip delays, and leading to increased exclusion. Severance is discussed in greater detail in section 2.2 below.

Deprivation and exclusion and unemployment

Poverty and social exclusion are spatially correlated in the UK, where some neighbourhoods have characteristics that exacerbate deprivation such as location, transport connections, housing type and economic base of the population. Some characteristics of the neighbourhood can impact directly upon a resident's ability to access opportunities leading to unemployment, poor health and isolation (Lupton and Power 2002:118). Creating a cycle of increased spatial concentration of deprivation, these disadvantaged neighbourhoods 'attract' through a lack of alternative choices, the most poverty afflicted members of a society. This perpetuates the negative characteristics of that neighbourhood, often exacerbated by social policy (Lupton and Power 2002:119). Characteristics relevant to this study of highly deprived neighbourhoods include vandalised bus stops, few local shops with high prices, physical isolation, high crime and intimidation by neighbours (Lupton and Power 2002:134). One theory put forward for the increase in relative deprivation in the last 40 years whilst absolute deprivation has fallen greatly, is the decline of manufacturing jobs in the UK since the 1970s. This saw a shift from skilled manual workforce to low skilled, unemployed or insecure part-time work. This 'New Economy' sees an increasingly larger gap emerging between the winners and losers (Lupton and Power 2002-23). Such highly deprived neighbourhoods contain families that suffer long-term joblessness and become socially isolated, dropping out of social networks that are vitally important to 'word of mouth' work opportunities. This increases low motivation and a family dynamic that contributes to poor attendance and/or performance at school (Wilson 1987:60, Lupton and Power 2002:126). It is also worth noting however that not all who are social excluded are deprived (e.g. financial poverty) and conversely, not all deprived are social excluded (Preston and Raje 2007:152).

Government approaches to tackling transport-related social exclusion

Social exclusion can be seen as an on-going process where people or communities are excluded on a broad spectrum. It is understood that there is a significant spatial element to this process, therefore public transport can be considered part of the solution (Priya and Uteng 2009:131). Both land-use and transport together can reinforce social-exclusion in some areas, with a lack of transport provision hindering jobseekers and contributing to the low levels of post-16 education take-up (Lucas 2006:820). Links between transport disadvantage and social exclusion were explicitly drawn within three major reports published by the government, the first a White Paper 'A New Deal for Transport, Better for Everyone' (D.E.T.R. 1998). Reduction of exclusion and deprivation were cited as policy goals of

improving transport, considering enhanced access as a way of increasing 'social justice' (D.E.T.R. 1998). The second report, the DETR's 'Social Exclusion and the Provision and Availability of Public Transport' (2000) highlighted the four 'A's of transport related social-exclusion issues:

- *Affordability*: whereby the cost, particularly financial, of a journey is such that it is not viable
- *Availability*: proximity to a bus stop, route destinations and timetabling are all significant variables
- *Accessibility*: the ease with which a person can utilise the transport system, including mobility issues for the elderly or disabled, clarity of service information and ease of access from home to the stop.
- *Acceptability*: cleanliness, safety, comfort of the transport and interpersonal skills of its personnel.

However many of these issues are rather subjective and at the time, no specified standards were set.

The Social Exclusion Unit (SEU) produced a significant study entitled 'Making the Connections: Transport and Social Exclusion' (2003), where (in)accessibility was suggested to be an underlying factor in the level of risk of exclusion. Several areas that were highlighted for attention for government initiatives included:

- Ease of access: how easily can people access a service within 'reasonable' cost and time?
- Information dissemination: timetable and routing information, and how to use the service.

This latter indicator was particularly of interest with regards to the success of 'demand responsive transport (DRT)' (Social Exclusion Unit 2003:2-3). From this, 'accessibility planning' was to form an element of subsequent Local Transport Plans (LTPs) by local authorities including two audits. The first would identify areas with poor access and accessibility and local disadvantaged groups that may consequently be excluded from key services. The second audit focused upon what local resources were available to the local authority to tackle accessibility issues. From these, action plans could be formulated at the regional level with other stakeholders such as land-use planners, local education authorities, Jobcentre Plus staff and Crime and Disorder Reduction Partnerships (Titherage 2003:3). Accessibility planning was also considered to provide the government with an opportunity to review local, regional and national problems, plan initiatives and the spending required to address the problems for different groups of people, communities and modes of transport. Similarly there should be greater synergy with land-use planning and regeneration projects (Lucas 2006).

Below is a list of potential strategies to improve accessibility:

Barriers to accessibility	Solutions
Physical access	<ul style="list-style-type: none"> • Accessible vehicles and stations • Driver training • Improvement to pedestrian environment
Transport availability	<ul style="list-style-type: none"> • Denser network and direct routes • Bus priority measures and enforcement • Early morning and evening services • Shared taxis and demand-responsive services • Car clubs • Wheels to Work schemes • Community transport schemes
Punctuality and reliability	<ul style="list-style-type: none"> • Bus priority measures • Performance incentives relating to punctuality
Cost	Promote awareness and use of schemes such as: <ul style="list-style-type: none"> • concessionary fares or travel vouchers • help with travel-to-interview costs • help with first month of travel-to-work costs • grants or loans for driving lessons or road tax
Information and travel horizons	<ul style="list-style-type: none"> • Simpler travel maps • <i>Traveline</i> and <i>Transport Direct</i> • Neighbourhood transport co-ordinators • <i>Travelsmart</i> – individualised marketing • Audio-visual information
Crime and fear of crime	<ul style="list-style-type: none"> • Better lighting or CCTV cameras • Graffiti removal • Improving the security of connecting walkways to transport facilities • Neighbourhood wardens • Travel wardens or police presence on buses or at transport hubs • Safe pedestrian routes
Safety from traffic	<ul style="list-style-type: none"> • Traffic calming • Safe play areas • Improved pedestrian crossings
Location and scheduling of services	<ul style="list-style-type: none"> • More accessible location of new services • Scheduling of health appointments to coincide with transport network • Staggered school start times • Use of information and communication technology and home delivery • Outreach to remote communities

Fig 2.6: List of possible approaches in accessibility planning (SEU 2003).

The SEU report noted that on-going evaluation of the Local Transport Plans (LTPs) accessibility planning initiatives was essential, which led to the creation of the Core Accessibility Indicators. These provided a number of measures of accessibility by public transport, walking, cycling and car to seven types of services: primary schools, secondary schools, further education, GPs, hospitals, food stores, town centres and employment centres (D.f.T. 2009a). LTPs should at the very least be able to ensure that decision-makers understand fully the limitations of accessibility in their area and the impact this has on the residents, with the validation of these plans made by those most affected by lack of transport provision (Lucas 2006:803-4).

The year 2008 saw the publication of 'Delivering a Sustainable Transport System' by the Dept. for Transport, which stipulated the need for equality of opportunities, including improved accessibility, enhanced regeneration and reduction of regional imbalance. Although the term 'social exclusion' is not explicitly mentioned, these goals correlate with many potential initiatives to reduce community exclusion (Preston 2009:141).

Exclusion resulting from inaccessibility limits the scope and location of available opportunities for some sections of society. Providing quantitative research across a range of socio-cultural groups (such as ethnicity, low-income single-parent families etc) and

accessibility to services that are beneficial and/or supportive, are the core agendas in a range of studies. Cartmel and Furlong (2000) explored the relationship between the exclusion of rural youth and exclusion related to low accessibility to education and employment opportunities. Assessing the barriers to travel experienced by different disadvantaged groups was carried out by Wixey et al. (2003:66-68), where the sample of unemployed people cited cost, carrying heavy items / pushchair, no direct route and infrequency or unreliability as reasons against bus patronage. Research into the accessibility for people with a disability for example, revealed how most accessibility measures ignored the range of people's mobility hence underestimating their actual accessibility to many opportunities (Church and Marston 2003). Another study explored how to link disadvantaged households to employment opportunities and demonstrated how inaccessibility has perpetuated the reliance on social welfare in some poor urban areas, as a key example of the social implications of poor spatial accessibility (Shen 1998, Kwan et al. 2003). Finally micro-access modelling between home and bus-stop via walking was conducted by Achuthan et al. (2010) regarding an elderly sample population in St Albans. They argue that this level of detail can influence the potential risk of exclusion for some.

Issues surrounding the initiatives' outcomes

A study authored by Titheridge (2003) sought to produce a framework to develop policies and planning practices that were effective in delivering socially inclusive transport at all scales. An appraisal system may be useful, for example the 'policy appraisal for equal treatment', that touches on issues relating to the exclusion of older people, and the impacts of gender and race relations (Titheridge 2003:7). This is of particular interest as gender along with household income and access to a car, is considered influential in shaping a person's travel behaviour (Hine 2007).

The D.F.T. noted limitations including the inability of current modelling practices to incorporate access to the transport network rather than just intra-network accessibility, where spatial and topological elements predominate over fiscal and temporal. There is no evaluation of the effects of trip-chaining, little differentiation in the attractiveness of opportunities, and clarity of trip purposes are causing studies to misrepresent the extent of social exclusion (D.f.T. 2006b:3-4).

Researchers also consider strategic accessibility planning to have shortcomings. Unimodal, aggregate statistics confound the extent of exclusion, and too many significant variables of transport-related accessibility are overlooked not least gender, age, disability, ethnicity and the spatial variability (Hine and Mitchell 2003:10-11, Preston and Raje 2007:159). In response to this, Preston and Raje (2007:156-9) define a matrix detailing levels of accessibility and mobility at the individual and community level so as to help shape policy responses to a variety of possible situations. Hine and Grieco (2003) explore the socio-

spatial-temporal facets of exclusion by proposing the spatial scatters and clustering that have repercussions as to the effectiveness of initiatives. Schönfelder and Axhausen (2003) demonstrate 'activity spaces' of different individuals. They conclude that a person's demographic characteristics were a secondary factor to overall numbers of unique locations that the individual visited when exploring the size and shape of 'activity spaces'. They also remark that there was no significant differentiation in the activity space size for those most often cited as at risk of exclusion (i.e. the elderly, low income and women) compared to others. Other weaknesses of accessibility planning in the UK system include token gestures that are made by some local authorities that do not consider themselves to have high-risk populations. The lack of ring-fenced funding which can be reallocated to different initiatives is also an issue as were stakeholder responsibilities that were not always clearly delimited, and there was no rigid implementation of socially necessary bus fares and evaluation frameworks (Lucas and Currie 2011).

Social exclusion and the research scope

Amongst the multitude of changes that take place at an MUP hub, local transport improvements, regeneration and increased numbers of facilities and services could ensue, with the potential for increased accessibility and reduced deprivation and exclusion. The impact indicator set (the Socio-economic Deprivation and Social Exclusion indicators in particular) endeavours to identify at a variety of scales where populations are at risk of exclusion and of high public transport need, to help planners incorporate changes that provide social equity to the whole hub community.

Sustainable mobility

The final section of this chapter briefly considers the impact of changes in mobility, towards more sustainable patterns of mobility, and the association between environmental aspects of transport sustainability, increased access and accessibility and reduced social exclusion.

There has been an inexorable rise in travel both in speed and distance travelled by people in the last half century, even though travel times have remained relatively stable (Banister 2008:73). This is generally accounted for by the increase in car usage as other modes have decreased (Steg and Gifford 2005:59), with the car-centric nature of urban development until the relatively recent past (Greene and Wegener 1997:177) and a pattern of increasingly long distance, car-based commutes (Horner 1999, Walsh et al. 2005, Werner and Evans 2011). Reversing these trends forms the central tenet of sustainable mobility along with aspirations for an improved quality of life for all (Steg and Gifford 2005).

Sustainable transport incorporates many aspects of the sustainability development agenda namely a widely recognised definition; 'balancing the needs and wants of today's populations without negatively impacting on future generations', based upon a definition attributed to the

World Commission on Environment and Development (Brundtland Commission 1983). Agenda 21 (Rio Earth Summit 1992) recognised the specific role of transport as a positive enabler of social and economic development whilst acknowledging the negative environmental impacts. This in turn informed the framework for sustainable mobility devised by the Commission of European Communities (1994). The Organisation for Economic Cooperation and Development (OECD) also proposed a working definition for environmentally sustainable transport in 1996, and subsequent studies, policy initiatives and local to national evaluations escalated in volume from that point on.

Promoting more sustainable transport solutions and land-use conditions whilst attaining increased accessibility to a range of spatially disjointed activities is considered a long term viable but difficult goal in urban transport policy (for example Jacobs 1961, Pushkaren and Zupan 1977, Newman and Kenworthy 1980, Murray et al. 1998, Bertolini et al. 2005). Sustainability of the transport system could encompass many social, economic and environmental (Replogle 1987, Goldman and Gorham 2006), as well as political or institutional elements (Zegras 2011). There have been calls to consider and work towards three so-called 'meta' goals, those of growth, intra-generational equity and inter-generational equity (Feitelson 2002:99-100). Some consider these to be conflicting (e.g.: Nijkamp 1994) and hence a balance needs to be achieved. For example, collective responsibility for a sustainable future for transport is seen as essential, in terms of co-operation from getting people out of their cars and into public transport, although there are questions as to how this can be seen as socially sustainable as many people rely on (and enjoy using) their individual cars (Cass et al. 2005). Indeed, the conflict between achieving a balance between social and environmental sustainability for mobility is emphasised by the conclusions of Shergold and Parkhurst in a recent paper (2010). They suggest that increased car ownership improves the quality of life for many of the elderly in rural areas regarding their ability to access healthcare and interact with their community. 'Sustainable development' and 'sustainable mobility' are also conflicting notions with economic growth in the context of fast-growing developing world cities, where population numbers are rising exponentially. Transport is necessary to sustain this economic expansion but this results in many planning management issues including how to limit the detrimental effects of pollution and accidents (Zegras 2011).

In a paper that considers government policy regarding sustainable transport, Goldman and Gorham (2006) discuss how since the publication of the Brundtland Commission Report (1987), the vision of sustainable development has been adopted by varying degrees over the world. The implementation of transport policy that followed has tended to fall into two paradigms. Policies described as a 'pathway' consider approaches that see sustainability as an ever-changing concept (process) and wish to encourage development to become increasingly sustainable. In contrast, some policies wish to attain a defined vision ('end-state') of a sustainable future system and suggest how transport can fit into this schema.

Both use indicators, but the authors feel that these approaches are overly simplistic in their understanding of the complexity of the system. They suggest a third way, which considers a 'system-based' approach, which considers the interaction between transport and further social and economic systems. A complex systems modelling approach was employed by Meadows et al. (1972) in a study often cited as an early leader in research into unsustainable growth.

Echoes of a systems-based approach were seen in the EU's Sustainable Mobility policy Measures and Assessments (SUMMA) which list 'outcomes of interest' which included economic (e.g.: accessibility, productivity, costs), social (e.g.: affordability, liveability, equity) and environmental factors (e.g.: resource use, pollution, noise) (Goldman and Gorham 2006: 264-6). The Eco-Towns Transport Worksheet (D.C.L.G. 2008a) appears to adopt this latter complex systems approach, remarking however, that where previous good transport planning practice existed, "it was rarely coordinated or implemented at a strategic level" (2008:5).

'Sustainable' accessibility

For a definition of sustainable accessibility that is principally social, Pennycook et al. (2001:4) suggest "everyone should be able to get to basic services such as shops, hospitals and jobs, easily, safely and affordably. The transport system should deliver this without damaging people's health and quality of life". From a more economic and environmental perspective, Bertolini et al. (2005:212) consider the definition of sustainable accessibility as "accessibility with as little as possible use of non renewable, or difficult to renew, resources, including land and infrastructure", with an emphasis on resources. Introducing land and infrastructure as resources to be exploited in moderation provides a strong incentive to think about sustainability beyond the natural environmental scope, although energy exploitation and consumption could be included. Combining environmental concerns with careful management of land and infrastructure resources as sustainability issues in transport, could make the sustainability agenda stronger in the face of formidable policy goals such as economic competitiveness (Bertolini et al. 2005:208). Zegras (2011) offers a further working framework for sustainable accessibility, which considers the sustainable mobility system to increase human capital (e.g. improved accessibility to healthcare and education) but not to the point where the mobility throughput required (the number of passengers transferred from one place to another in a specified amount of time) depletes human-made (e.g. infrastructure), natural (e.g. fuel, land) or social (organisations, institutions) capital. Or more simply put 'providing more utility (as measured by accessibility) per unit of throughput (as measured by mobility)'. He ascertains that improved accessibility is the goal of sustainable mobility and throughput is the cost, which varies by mode, technology, time of day and occupancy level. Therefore walking or a full bus is more sustainable than a single occupancy car.

Sustainable mobility planning and delivery

Banister (2008) considers the main foci of sustainable mobility planning and delivery to be grouped into four main themes;

1. Reducing the *need* to travel: This includes the possibility of removing the journey by use of Information Communication Technology (ICT) (Lyons and Kenyon 2003), substitution of activities, more flexible travel patterns and fewer longer distance trips (e.g. Banister and Stead 2004, Mokhtarian et al. 2006). This is related to the issue of 'dormitory towns' where new housing developments contain little more than education and shopping facilities without any significant local commercial or industrial employment. Here the residents have to commute to other workplaces, only sleeping within the development and there is a high dependency on non-local travel either by car or other modes. This is cited as a concern by residents in several rural communities that are potential locations for residential growth and where the planning system is not providing sufficient services and facilities. The forecast increase in population, only serves to provide a bus service with the critical mass necessary to make it viable - in theory (Halfacree 1995, Atkinson 2000, Gallent and Robinson 2011). This is not restricted to rural communities, for the 'dormitory estate' effect can similarly occur as (sub)urban infill, where economies of scale (new population influx and viability of services) exist (Pacione 2004).
2. Modal shift: this is the promotion of walking, cycling and public transport with reduction in the need for car use (achieved through parking controls and road charging measures) and improvement in the quality of the public transport, pedestrian and cycling environments. Modal shift along with attempts to reduce the need to travel so much are deemed to be hardest to implement as they require a shift in attitude, and a reduction in personal flexibility and comfort for the benefit of society (Banister and Marshall 2000, Pucher and Dijkstra 2003, Steg and Gifford 2005 provide discussions regarding the changes in quality of life resulting from sustainable transport).
3. Distance reduction: this describes reducing the physical separation of activities and incorporating sustainable mobility goals into land-use patterns and urban form. These include increasing urban density, encouraging greater mixed-use development, and promoting public transport friendly development (Banister and Hickman 2006).
4. Technological innovation: whereby engine design and energy sources are increasingly 'green', reducing emissions and noise. Spatial segregation for vehicles that do not meet acceptable guidelines are in operation (for example the Low Emission Zone in London), and capacity is being increased for passengers in cars and freight (Banister 2008:75). However such technological advances are outweighed by ever increasing car use, where drivers use their cars more as they

are more energy efficient, an issue known as 'rebound effect' (Berkhout et al. 2000). Also, technological improvements do not address shortcomings in accessibility alone, and are potentially unattainable for lower-income groups (Steg and Gifford 2005:60).

Banister considers that these issues are often cited as to why sustainable mobility initiatives are sometimes unsuccessful (see also Banister and Marshall 2000). These could be resolved in part by positive involvement of stakeholders and members of the community in order for the measure to be accepted. This may include participatory inclusive action to make the policy goal work such as reduction of congestion through fair (to society and the individual) action such as reallocation of space away from car traffic, cycle networks and building upon high levels of public acceptance to combine trips and reduce trip lengths (Banister 2008:76).

Sustainable mobility: how do we know that we are making progress?

Operationalising the principles inherent in the Brundtland Report's (1983) definitions of sustainable development are not without problems. Not least is the subjective nature of quantifying complex, multi-dimensional changes with regard to defining the end goals and objectives, deciding geographical and temporal scales and which attributes to select (see Jeon and Amekudzi 2005).

Performance indicators for assessing the 'sustainability' of transport ought to be derived from visions of a sustainable system and evaluations of how the system is moving towards that end state. Besides system performance measures or cost-benefit analyses, such indicators could include pollution targets, fragmentation of areas, costs and affordability and accessibility (Litman 2007). Furthermore, a holistic understanding of local and regional travel patterns is essential for creating context-relevant socially sustainable mobility indicators. Three studies of many examples explore the effect of socio-economic demographic characteristics upon journeys made. The first study is of the transport system in Lyon, where the authors aim to capture the complexity of travel issues (such as environmental pressures, economic costs and the level of achievable social participations) but create easy to understand outputs (Nicolas et al. 2003). The study concludes that the size and structure of the household establishes the range and location of activities and trips, and also that lower-income households on average expend more than 15% of their budget on travel costs, making them highly vulnerable to changes, such as fuel price rises (Nicolas et al. 2003:204-05).

The second study employs a discrete choice econometric methodology to consider the influence of demographic attributes for the journey to work. This type of trip, due to its cyclical and predictable pattern, has a strong potential opportunity for transport planners to

manipulate (Commins and Nolan 2011:260). Results for this recent study suggest that the dominant attributes that shape the commute to work include: a 'central business district' (CBD) work location, age and gender, marital status, car availability and household composition (particularly the presence of young children). Journey time was the key factor in a person selecting a particular mode over other potential influences, and significant at all levels (Commins and Nolan 2011:265-66).

Finally, Lucas et al (2007) provide a structure to define the social sustainability of transport and land use policy, identifying equality of opportunity (i.e. distributional effects) and improvements. The indicators assessed are poverty (total expenditure on travel costs), accessibility (weighted journey times to employment, health and education locations), health and safety (transport related injuries and deaths), quality of life (liveability through safe walking and cycling) and housing (land-value uplift and affordability, severance blight). When applying the approach to a case study area, the authors remarked that value judgements needed to be made regarding which indicators should be incorporated into a sustainable transport policy evaluation, given the context-specific nature of the intervention (Lucas et al. 2007:34). However, despite the relative sophistication of the modelling and GIS software used, many variables for the case-study proved to be too aggregated, or over-simplified the reality of the impacts. This failed to give the evaluation as much research value as was anticipated (Lucas et al. 2007:36-37).

Sustainable mobility and the research scope

The MUTP will alter the travel patterns of the hub, either by mode, preference for different destinations and/or distance and time travelled, and a more sustainable transport system both locally and regionally would be a congruent aim. The impact indicator (Journey to Work indicator) will explore the distances travelled for the journey to work for the least and most deprived, the changes in levels of car use and the demographic attributes against all modes for both the case-study hubs. From these data, local planners could formulate sustainable mobility indicators to monitor changes made with the delivery of the MUTP and provide details within the project's appraisal. From the social impacts of transport, the following section considers the potential impacts of land-use changes associated with the delivery of an MUTP.

2.2

MUTPs and the social impacts of land use changes

MUTP-led urban redevelopment and regeneration

Definition

An early UK policy document that explicitly referred to 'urban regeneration' was a report written in 1975 for Merseyside County Council, describing the need and possible issues relating to regenerating areas of dereliction, with poor appearance, low accessibility and other negative attributes (Merseyside County Council 1975:7). More recent definitions include

"To enhance the quality of life of local people in areas of need by reducing the gap between deprived and other areas and between different groups" (D.o.E. 1994)

In 2006, the chief executive of the British Urban Regeneration Association considered regeneration to be

"...a comprehensive and integrated vision and action which leads to the resolution of urban problems and which seek to bring about lasting improvement in the economic, physical, social and environmental condition of an area" (Ladd 2006)

Despite the three decades between the first and last example above, there is a consistency between the scope and aspirations to ameliorate the most deprived urban areas.

Characteristics of urban regeneration projects

Given the nature of residential buildings in central urban areas (relatively lower density, older houses), regeneration of a partially derelict or deprived inner-city area requires a step-change strategy to breathe new life into a community. These areas suffer from socio-economic neglect due to changes in industrial and social fabric and (sub)urban sprawl or outer-city relocation. Regeneration differs from development as it aspires to promote sustainable urban socio-cultural and economic growth, improve infrastructure, reconstruction of the spatial structure and encourage new uses for public and private benefit (Yu and Kwon 2010:2). Regeneration projects often have a large and ambitious remit, and as such these flagship projects are termed 'prestige schemes' and have a significant impact upon the surrounding city or region. Loftman and Nevin (1995:300) consider such a project to be:

"Pioneering or innovative, high profile, large-scale, self contained development, which is primarily justified in terms of its ability to attract inward investment, creates and promotes new urban images and act as a hub of a radiating renaissance, facilitating increases in land values and development activities to adjacent areas"

These prestige regeneration schemes often share similar characteristics. Pertinent to this study, their locations often coincide with landmark buildings, major office complexes, pivotal transport hubs or leisure / sporting facilities. They often require the developer to invest up-

front in transport infrastructure along with housing and education facilities (Bianchini et al. 1992, Loftman and Nevin 1995, Percy 2003).

Urban regeneration projects and MUTPs

The symbiotic relationship between an MUTP and a regeneration scheme can be observed in the on-going consultation for the Vauxhall - Nine Elms - Battersea regeneration, and the requirement implied by the development promoters (Treasury Holdings and Transport for London) for an extension to the Northern Line [www.northernlineextension.com]. The proposed creation of 3,400 (c10,000 new residents) homes and c10,000 jobs in this mixed-use regeneration development requires the extra capacity of an underground line extension to render the development fully accessible, over and above possible tram, riverboat and bus options (N.L.E. Feasibility Studies 2008). A former example of successful area regeneration as perceived by (most) local residents was the Jubilee Line Extension in east London (e.g. Gatersleben et al. 2007).

Grieco (1994:300) provided a literature review of the state of knowledge in the mid-1990s, which was technical and qualitative, regarding the relationship between transport infrastructure investment and the impacts upon inner-city local economies. She notes that the impact of transport projects have been incorporated into current appraisal to a very limited extent, and many evaluations of transport projects lack a systematic framework with which to consider the effects. Lawless and Dabinett (1995) explored the effect of a transport project in Sheffield (the South Yorkshire Supertram and link roads) in providing the catalyst for urban regeneration of the Lower Don Valley. They remark that transport investment ought to be better incorporated within urban policy. A 'dysfunction' is later perceived in a follow-up study of the above transport and regeneration project, where opportunities for wider benefits were missed, and the authors suggest there should be a closer integration of infrastructure funding and the transport improvements (Lawless and Gore 1999:542-544).

In a paper considering the influence of twelve mega transport infrastructure projects upon local regeneration projects in Europe, Gospodini (2005) assesses the outcomes of the EC-funded Transecon Project (2001-03). She concurs with Lawless and Dabinett's observation regarding the limited role MUTPs have in socio-economic urban policy. When assessing the twelve case-studies, the Transecon research partners considered five questions:

- Can new transport infrastructure generate a shift in the land-use pattern of the area? And what kind of a shift this might be?
- Does new transport infrastructure increase construction investments (e.g. construction of new buildings, reconstruction/renewal of existing buildings) in the area?
- Does new transport infrastructure increase public investments in public open spaces (e.g. construction, renewal of equipment of space in squares, parks, pedestrian streets, etc) in the area?
- Does new transport infrastructure produce a rise in real estate prices and rents in the area?

- Can new transport infrastructure, by means of development and redevelopment schemes, improve the image and the status of the area? Or, in other words, can new transport infrastructure enhance the 'brand name' of the area? (Gospodini 2005:1087)

As with many broad, comparative studies, comparison of data from different spatial and temporal contexts is fraught with problems (Gospodini 2005:1105). However the twelve cities show a great deal of variety in the extent to which the urban regeneration occurred around the MUDP, sometimes clearly impacted greatly and others where it is very unclear or incidental. The most significant, multidimensional factors that shaped the outcome of the urban regeneration were:

- The type of transport infrastructure project
- The condition of the built environment in the transport corridor area
- Existing local market demand for new space and accommodation of new land uses
- The local economic situation
- The local institutional framework and political milieu. (Gospodini 2005:1108-10)

These conclusions are supported by Flyvbjerg et al. (2003:71-72), who remark that whilst substantial economic development is usually anticipated to follow in the footsteps of the delivery of an MUDP, post-project evaluations suggest that this is often not the case, and that particular conditions need to exist for this to occur. These include the lack of existing capacity, if the new capacity and additional transport savings result in large-scale relocation of households and companies, and when there is a combination of investment in infrastructure and social capital. Further detailed discussion regarding the social impacts of transport projects is provided in chapter 3, the evaluations of MUDPs.

Urban redevelopment and regeneration: Government initiatives

In the last three decades, the aims and objectives of a regeneration project have shifted from market-led property and economic growth orientation typical of the post-1979 Conservative government, to brownfield-led socio-economic and environmental promotion (Davies 2002, Ball and Maginn 2005, Raco 2005). The Thatcher years saw strong central government control (through Urban Development Corporations) in partnerships with the private sector and the creation of 'enterprise zones' where planning controls of the development were effectively abandoned, and seen as 'obstacles' to regeneration (Couch et al. 2011:34-35). Heseltine launched 'City Challenges' in 1991, where competitive bidding for projects disregarded the level of socio-economic need in lieu of attractiveness of the bid. From 1994, the new 'Single Regeneration Budget' (SRB) had the remit to fund and initiate urban and rural regeneration projects for deprived areas with area regeneration partnerships comprising national (English Partnerships), regional and local government bodies and private organisations. SRBs offered the opportunity for more 'bottom-up' planning where the priority and needs were determined at a local level, and aimed to address issues of social exclusion and promote sustainable regeneration amongst other objectives, which were achieved to some extent (Tyler and Rhodes 2007). The SRB was replaced in 2001 by Regional Development Agencies (RDAs), which are now to be phased out in 2012 and

replaced by Local Enterprise Partnerships (LEPs). RDAs were strongly orientated towards promoting and sustaining regional economic growth with lesser remits to deliver government objectives regarding social inclusion and environmental issues, with a strong reliance upon central government for financial budgets (Jones and Evans 2006). Working alongside more locally accountable Urban Regeneration Companies (URCs), the RDAs were credited with influencing the re-occupation of central urban areas and the end of outward urban sprawl, including rising house values, employment, culture and commerce revitalising previously depressed areas (Couch et al. 2011:36). Subsequent to the publication of the 'State of the English Cities' report (Parkinson et al. 2006), the URCs were replaced with City Development Companies (CDCs) in recognition of the city-region scale (as opposed to region-national) of initiatives to boost economic competitiveness and regeneration (ibid.). This brief synopsis serves to illustrate the changes in perception of, by whom, and how regeneration should be tackled, highlighting the elements of the power and the processes that have taken place over the last thirty years.

Socio-economic impacts of urban regeneration

Positive achievements:

'Neighbourhood renewal' is a term coined in policy around 1989 when the government moved away from General Improvement Areas, to a broader scope of area regeneration, including social, economic, environmental issues by both the public and private sector organisations. These carried out works including the demolition of 'sink housing estates' and unpopular tower blocks, whilst renovating poor quality housing stock and/or constructing lower density lower-rise flats (Couch et al. 2011:37). The 'New Deal for Communities' (1998) hoped to address problems associated with areas of intense multiple deprivation. There were five objectives; job creation, crime reduction, improved education achievements and health, and improvements to the standard of housing and the environment, over ten years. In an evaluation of the approach, Beatty et al. (2008), suggest that some of the initiatives were successful (improved area satisfaction and reduction of overall crime) and some less so (relatively low achievement of unemployment, education and health-based outcomes). Similar objectives were inherent in a contemporary initiative 'A New Commitment to Neighbourhood Renewal' (O.D.P.M. 2001), and Local Strategic Partnerships (LSPs) oversaw the coordination of all relevant public and private organisations involved in the regeneration project. Critiques of a later government initiative, the Housing Market Renewal (HMR 2002) programme, consider the outcomes to be mixed. The HMR aimed to 'remodel' neighbourhoods; demolish areas with many derelict properties, low demand for social and private housing and high turnover seen primarily in the North and Midlands. Whilst there have been some community concerns (see Allen 2008), generally this regeneration has revived the local housing market and there was some evidence of rising aspirations (Cameron 2006:14). Furthermore, Cameron and Coaffee suggest that the programme served to re-attract the wealthier middle-class back to the urban core (ibid.). Rogers (2005)

has also discussed the urban renaissance of city centres in the last 10-15 years, and the impacts of new mixed tenure developments.

Challenges of urban regeneration:

Prestige projects are usually associated with high-end property-led development which impacts local residents that are on lower-incomes due to resultant escalating land and property values rendering homes and facilities beyond their means (Bianchini et al. 1992:251-252). The Commission on Integration and Cohesion was created in 2006 and disbanded in mid-2007 to find ways to avoid socio-cultural segregation. Their two final reports 'Themes, Messages and Challenges' and 'Our Shared Future' highlighted, amongst several factors, the need to monitor the negative effects of a regeneration scheme which could see the influx of young, mobile professionals, displacing working class populations and increasing house values in the wider community (C.I.C. 2007a:20).

Studies evaluating the social effects of regeneration policies (see Atkinson and Kintrea 2004, Bolt and Torrance 2005) consider issues such as; how do old and new residents mix? Are there social contracts between different demographic types? And does gentrification enhance a positive sense of neighbourhood? Generally, study outcomes indicate that there is very little mixing due to differences in values and socio-cultural norms, and long-term neighbourhood residents can range from indifference and mutual exclusion to tension and dissatisfaction (e.g. Blokland 2003).

Finally, despite efforts made over the last three decades to revitalise inner-city areas, they still contain the majority of areas that are relatively most deprived (Couch et al. 2011). An assessment study as to why this is the case found that there were limited behavioural, cognitive and environmental dimensions of most community-based regeneration programmes (Gardner 2007).

Urban regeneration and the research scope

Discussed in more detail in the Subject and Sample chapter 5, the main case study, Ebbsfleet, was scheduled to undergo a significant development and local regeneration programme, currently in stasis following the housing crisis. Ashford, the comparison case-study, is classed as a 'Sustainable Growth Opportunity Area' and will also experience extensive new development, and the case-study MUDP will provide extra transport capacity for longer distance commuters. These MUDP-related development or regeneration projects will inevitably change the character of the surrounding communities and have social impacts that could be both positive and negative. These are explored in the Demographic Profile, Socio-economic Deprivation, Physical Barriers and Community Cohesion indicators of the impact indicator set.

Barriers: the physical infrastructure of the MUP

This second sub-section considers the social impact that the physically and psychologically imposing infrastructure of an MUP could have upon a surrounding community, by severance, relative spatial confinement and community segregation. There are many perspectives relating to these issues, and the discussion below is a brief account of some variable studies to provide an insight into these themes.

Community severance by the physical infrastructure of the MUP

The Social Exclusion Unit's 2003 report 'Transport and Social Exclusion: making the connections' described situations where the infrastructure of a transport project can reduce people's quality of life, their ability to move about to access facilities and services, impair social networks and increase the risk of low community cohesion.

Common elements of severance include:

- Physical barriers: impermeability of infrastructure
- Psychological or perceived barriers: noise and safety
- Social impacts: low cohesion and community fragmentation (DfT 2005:21)

A study concerned with the movement of pedestrians and main roads identified two types of physical barrier severance; static (which comprised artificial high and impermeable structures like embankments that made interacting either side very difficult or impossible) and dynamic (the flow of traffic on the road) (Guo et al. 2001:2.1). This could result in a decrease in local access defined by Tate (1997) as lengthening an individual's journey 'trip delay' or having to take a more circuitous route, a 'trip diversion'.

Psychological barriers caused by transport infrastructure have been recognised by Clark et al. (1991:11) as four potential changes to individuals' behaviour:

- Traffic noise being too loud and discouraging cyclists and pedestrians
- Pollution from heavy traffic also discouraging cyclist and pedestrians from using the road
- Perceived danger of being hit by speeding and/or high volume of traffic making it frightening
- Trip suppression where the unpleasantness of the infrastructure means an individual will decide against making a journey

Whilst severance from the transport project (road or rail etc.) can be considered a primary impact, poorly designed and maintained mitigation measures form a secondary severance. In a case study of a community impacted by a ring road, these secondary inadequate mitigation-measure severances included;

- Reluctance to use the pedestrian subway due to feelings of fear of being a victim of crime, poor accessibility regarding the steepness of the ramp especially in some weather conditions, and the entrance/exit of the ramp being difficult to negotiate with a pushchair or wheelchair. Sometimes there is poor maintenance leading to a build up of rubbish, vandalism, loss of lighting and flooding (D.f.T. 2005:48-51).

- Footbridges can cause problems if the ramps are too steep and inaccessible for some with mobility issues, and can be badly lit and make people feel 'hemmed in' and unsafe. Their location, as with the subways, are not always positioned along locally defined 'desire lines', resulting in further trip delays (ibid.).

Further conclusions from this case study suggested that in the thirty years since the construction of this ring-road, the perception of severance had not diminished as the mitigation measures were poor and nothing had been done to resolve the barriers. Evidence also suggested that people sometimes resorted to using their cars to make a journey that could have been carried out on foot, but for the fear of the traffic and subway. Finally the study revealed that there were differentiated impacts related to severance depending upon the time of day, mobility requirements and the social group of the individual. There was inequity of impacts as disadvantaged populations tended to bear a disproportionate share of the costs as they tended to rely most on non-car modes of transport (Feitelson 2002:104). A demographic variability in impact levels is noted in Hine and Russell's research (1993, and 1996) regarding pedestrian behaviour and traffic conditions on a major road in Edinburgh. The differences in impacts observed can help shape the type and location of traffic calming mitigation measures appropriate to various pedestrian needs.

In an example of neighbourhood severance as a result of a new railway extension in Scotland, the environmental impact assessment evaluated the potential decrease in amenity such as prolonged exposure to trains, dirt, poor air quality and noise pollution as well as extended trip durations and diversions caused by the line (Ironsides Farrar 2006). Mitigation measures include re-routing a major cycle network path, new footbridges (ramped and lifts) and road-bridges regarding accessibility, and new planting and noise barriers, natural habitat enhancement and landscaping as environmental mitigation measures (ibid. 30-33.).

Spatial confinement by the MUTP infrastructure

The impact of an MUTP infrastructure such as a railway line could contribute to continued deprivation, high crime and population turnover, exacerbating the situation for low-income, car-less residents, who are unable to 'self-mitigate' the barriers (D.f.T. 2005:56).

"Areas cause poverty if the social processes associated with an area create or shape the problems of poverty" (Spicker 2001:3)

The suggestion by Spicker and others (see also Lee and Murie 1997, Brodsky et al. 1999, Power and Wilson 2000, Orford et al. 2002) suggest that although it is undoubtedly accurate that not everyone living in a poor area is in poverty themselves. Yet by living in such an area (in close association with people in poverty), everyone suffers a certain degree of disadvantage which exposes them to a higher risk of deprivation (Spicker 2001:1). Whilst it is important not to misrepresent the population in these 'deprived' areas through choosing area definitions that exacerbate the ecological fallacy, one should make the distinction between

aggregated population attributes and *collective* attributes. The latter implies that there are spatial concentrations where more deprived people are located due to limited opportunities and that these poor areas themselves have characteristics such as poor quality housing and local resources (Shaw 2004, Lee et al. 2005, Pearce et al. 2006). Moreover, certain sections of the population with issues such as mental health problems, and long-term unemployment can exacerbate spatial deprivation, and collectively impact upon the neighbourhood's residents' quality of life (Spicker 2001, Fone et al. 2007).

So if one were to accept the notion that some areas are more prone to deprivation over time, does the addition of a linear barrier, increasing the spatial segregation further intensify the situation? Historically it would seem so. An interpretation of Charles Booth's *Descriptive Map of London Poverty* by Hyde & Reeder remarks

"A more careful reading [of the map] indicates how some new addition to the ground plan; a dock or canal for example, a gas works or water works, a railway line or just the alignment of a new street seems to have served to reinforce slum tendencies" (Hyde and Reader 1984).

Booth also noted that the poor

"... were located in pockets of streets lying between railway and canal in districts cut off from the mainstream of urban life" (Booth 1892-7:137, cited in Vaughan 2005).

The construction of a railway line through an urban area does not have a generic impact. A railway viaduct provides greater physical permeability but reduced visual permeability, whilst the use of a submerged cutting provides continued visual contact with neighbouring areas but relatively more restricted movement and less permeability across the line (see Marshall 2005 for a critical assessment of permeability and connectivity impacts). These are ideas inherent in Space Syntax analyses. Hillier and Hanson (1984) proposed this methodology to describe configured inhabited space so as to extract the underlying 'social logic' and potential explanations for socio-cultural patterns of behaviour (see Bafna 2003 for a detailed explanation). Vaughan (2007) utilises space syntax analysis to study multi-scale relationships between spatial form, social segregation and poverty from street- to city-wide level. She considers there to be a:

"spatial mechanism involved in the creation of poverty in areas which leads to a strong correspondence between spatial segregation and poverty" (2007:230)

Levels of permeability can also have impacts upon levels of crime discussed in case-studies of urban areas, for example Perth with low permeability (Clare et al. 2009) and The Hague with relatively high permeability (Peeters and Elffers 2010), and this clearly affects the macro-level decision-making of burglary. The complexity of the context appears to hinder any strong correlation between permeability and crime levels, although the lower the permeability of the target area, the longer the trip distance and hence the higher the

incidence of burglary is a general underlying pattern (Greenberg and Rohe 1984, Ratcliffe 2001, Clare et al. 2009).

Community Segregation: a physical barrier to ease inter-community tension

This social impact is related to the redevelopment and regeneration of an area that can accompany an MUDP, as is the situation with the main case-study Ebbsfleet. In urban planning research, several studies have suggested that physical barriers can impede social integration with new populations, giving rise to prejudice (see Massey 1985, Kraus and Koresh 1992). Yet in other cases, the reduction in encounters in public spaces between people of different ethnic or social class also reduces tension and socio-cultural friction (Spain 1992).

In a study exploring the effects of urban design in three different residential developments in Israel, Billig and Churchman (2003) found, following interviews with old and new residents of a neighbourhood that contained a new housing development, that physical barriers impacted on community cohesion. Since there is land availability pressure in Israel, as in the UK, the regeneration of neglected areas provides several benefits. Yet, like Ebbsfleet, there are often social class differences (and/or ethnic background in their study) between the occupants of the old and new residences in Israel, altering the demographic profile of the neighbourhood (Billig and Churchman 2003:227-8). Their three case studies are residential buildings with a variety of barriers between the old and new neighbourhood occupants which resulted in a spectrum of interaction both visually (how much they could see each other from the homes and street) and physically (how often they encountered each other in public spaces, or at facilities such as shared shops or schools). They found that there was a marked difference, with the residences that had the least physical barriers resulting in both populations feeling uncomfortable. The higher social class was deemed as behaving with snobbish distaste of their neighbours and leaving the old population with feelings of resentment and inferiority (Billig and Churchman 2003:234-7, and also Faunce 2003). However, the residences with more defined physical barriers resulted in much less friction, with both groups able to retain their social identity and norms, heightened perceived security from the new population, and less a feeling of disruption to the traditional social fabric from the old population (Billig and Churchman 2003:238-9). Dixon and Durrheim (2004) discuss the social psychology of community desegregation and loss of 'self-place identity', where increased dissatisfaction is associated with a previously more homogenous place.

The conclusions of Billig and Churchman suggest that there could be too much enforced social interaction with a new population of a different demographic background whereby cultural differences were negatively emphasised to the detriment of both groups (see D.C.L.G. 2008b and, Flint and Casey 2008 for examples of studies of inter-social class tension). Therefore a lack of physical separation led to a prominence of perceived social

boundaries, unwelcome and resented by the whole neighbourhood (Billig and Churchman 2003:239-45). The studies do note that total exclusion, such as gated communities found in North and South America, also worsen inter-social group tension, as complete unfamiliarity fosters a sense of suspicion and distrust (Caldiera 1999, Billig and Churchman 2003). However, current government intervention advice regarding inter-community tension does not promote the instigation of barriers, they include for example;

- dissemination of information and reassurance to vulnerable groups
- outreach to local faith leaders
- LA to contact community groups to suggest public messages of solidarity
- Positive youth engagement. (D.C.L.G. 2008b:12)

The potential positive effects to reduce inter-community tension via low-level, subtle barriers is a very localised, micro-scale approach and as such could be worth considering at the scale of the street 'boundary' between the new development and existing residential area.

MUTP physical barriers and the research scope

The Physical Barriers Impact Indicator comprises four sub-indicators; neighbourhood division (severance), relative spatial confinement, community segregation and impeded accessibility. These social impacts can occur at the hubs, and not all are explicitly incorporated into MUTP appraisals although their negative effects can be highly detrimental to (non)users' lives. This literary review has briefly explored some pertinent ideas and research outcomes that serve to highlight how transport infrastructure has been evaluated. Two of the sub-indicators - Neighbourhood Division and Community Segregation - are also inputs for the Community Cohesion indicator.

Community cohesion

Definitions

Like 'sustainability', 'social cohesion' can be a very nebulous term, evolving to suit politically current issues, with its roots in social psychology (where the emphasis was on personal sense of belonging), or more commonly sociological theories derived from Durkheim, with a focus on systemic approaches to integration (e.g.: Landecker (1951) and Kanter (1968). Such research foci often tended towards the abstract rather than pragmatic in ascertaining a community's cohesion, or lack of (Chan et al. 2006). Early research considered the effects of cohesion upon individual and group behaviour in an area (Maccoby et al. 1958, Deveraux 1960), the effects of demographic diversity (Gans 1967), urban form (Kuper 1953), social neighbourhood hierarchy (Coleman 1957) and transport impacts (Burkhardt 1971). Current ideas regarding community cohesion can range from being able to join in local social events or just conversing with one's neighbours, activities that are expected to generate and promote a sense of closeness or belonging within one's community and are the building blocks of a civil society (Crow 2002, Friedkin 2004). One definition that shares common elements with many others is suggested by Chan et al. (2006:290):

“Social cohesion is a state of affairs concerning both the vertical and horizontal interaction among members of society as characterised by a set of attitudes and norms that include trust, a sense of belonging and the willingness to participate and help as well as their behavioural manifestations”.

From this definition, aspects of community well-being and mutual benefit, and the significance of personal and a group sense of belonging and acceptance are implied. The sections below discuss how people and neighbourhoods can affect cohesion, and how relative cohesion can impact upon people and their environment. This is followed by several potential cohesion measures, an overview of recent government policy initiatives and their effectiveness in improving cohesion in some disaffected areas.

How community cohesion can affect people and neighbourhoods

A study conducted by the World Health Organisation (WHO) concluded that social cohesion at many scales is beneficial to a populace economically, physically and emotionally, and is linked to improving a range of health issues, including heart disease and complications in pregnancy in vulnerable people (Wilkinson and Marmont 2003:22). Relatively cohesive communities were also found to have high levels of interaction and a strong sense of community (Hirschfield and Bowers 1997, Helliwell 2004).

Work to improve community cohesion is largely centred upon reducing the negative impacts of low cohesion. A lack of social cohesion, particularly related to growing demographic heterogeneity, is considered to have enduring adverse effects upon individual's psychological wellbeing. Increased risk of relative deprivation, decreased social capital in the neighbourhood and greater socio-cultural disorganisation are common results of low cohesion (Bourguignon et al. 2006, Putnam 2007). Neighbourhoods with little cohesion were disintegrated with poorly defined social networks and where residents shared very few if any common interests, which had knock-on effects related to social disorder. In a study to assess if the level of social cohesion was a factor on the level of crime, it was found that areas deemed to be more cohesive had lower crime levels than areas equally deprived but with little cohesion. The lack of control over more 'rowdy' elements of the community, namely teenage gangs, was seen as indicative of low social cohesion, and outside intervention was required such as police assistance (Hirschfield and Bowers 1997:1274-75).

How neighbourhoods and people can impact upon cohesion

The prevalence of organisational membership can improve community cohesion and therefore resident's satisfaction with their personal lives, including religious, sporting or other cultural organisations, as well as local volunteering (Helliwell 2004). 'Mixed communities' or neighbourhoods with social diversity, where there is a variety of tenure (hence income, socio-economic groups, lifestyles and ages) can sometimes lead to the avoidance of high concentration of deprivation. Benefits include the breakdown of a neighbourhood's poor

perception, which often occurs with single tenure (social housing) areas. Furthermore population turnover is reduced as a higher quality of life is achieved (Bailey and Manzi 2008). (See Coffé and Geys (2007), Johnson (2008) and Weber (2009) for recent discussions of the benefits of social heterogeneity). Neutral outcomes of mixed communities may be general ambivalence between neighbours and no marked increase in employment opportunities arising from such a development (Bailey and Manzi 2008:3-9).

Efforts to achieve a more socially cohesive society can sometimes be at odds with other social values such as diversity and creativity, and thus, depending on socio-cultural context, cohesion has to be balanced with such other values (Sim et al. 2003, Chan et al. 2006). However diversity can sometimes be viewed negatively; homogeneity-orientated theories regarding community cohesion suggest that community members prefer, and are more inclined to trust those with shared values such as education and wealth levels (i.e.: homophilic tendencies) (McPherson and Smith-Lovin 2002, Jordahl 2009, Kossinets and Watts 2009). Disadvantages of mixed tenure include lack of forethought in implementation, where a 'one-size-fits-all' approach has caused tension between households with different lifestyles and values. Closer assessment of local conditions and/or micro-grouping of tenure types within the development are useful in reducing undesirable outcomes (Bailey and Manzi 2008:3-9). The Commission on Integration and Cohesion (C.I.C.) was created in 2006 to find ways to avoid socio-cultural segregation. It was disbanded in mid-2007. They chose to separate the terms 'social integration' and 'social cohesion', indicating that integration is particularly the process where there is good adjustment between old and new residents in a community (C.I.C. 2007b:9). With this in mind, their definition of integration and cohesion was as follows:

“There is a strong recognition of the contribution of both those who have newly arrived and those who already have deep attachments to a particular place, with a focus on what they have in common” (C.I.C. 2007b:10)

In a more recent publication 'Guidance for local authorities on community cohesion contingency planning and tension monitoring' (D.C.L.G. 2008b), as the title suggests, there is concern that inter and intra-community conflict - be it social, economic, racial or ethnic - is a core component in failing cohesion. The report notes that;

“A key contributor to community cohesion is integration which is what must happen to enable new residents and existing residents to adjust to one another” (ibid.6)

The report continues by emphasising the importance of equal access to opportunities, trust and an on-going sense of belonging and meaningful interaction between community residents.

Following the argument by Spicker (2001) and others above relating to 'poor areas', the sense of indifference or detachment felt by residents of a disadvantaged area, living there because of a lack of options can lead to low cohesion (Van Marassing et al. 2006). This

contributes to poor health (Pickett and Pearl 2001) even controlling for socio-economic status (Fone and Dunstan 2006). Other suggested proxies for low cohesion were high population turn-over, low socio-economic status and social heterogeneity (social class, tenure, physical features of property) (Hirschfield and Bowers 1997:1279).

Potential cohesion measures

A past example of multi-dimensional variables considered to be significant for measuring neighbourhood cohesion is given by Burkhardt (1971) and includes;

- Neighbouring: the extent of neighbouring or interpersonal interaction that occurs
- Use of local facilities: the extent to which residents conduct their business at local facilities (food shops, schools, work places, doctors' offices, churches and banks) as opposed to non-local facilities
- Participation: the extent to which residents participate in organisations whose members are residents of the neighbourhood or whose primary focus is generally neighbourhood problems or activities
- Identification: the extent to which persons identify themselves as belonging to a distinct social community and the extent to which persons feel that they reside in a distinct area
- Commitment: the commitment of the residents to the local area as expressed by their desire to continue living there
- Evaluation: the extent to which residents evaluate their neighbourhood as a place in which they would like to live. (Burkhardt 1971:86-87)

Over thirty years later, research by Blokland (2003) re-categorises these influences into four overarching themes that consider the ties that bind community members;

- Interdependencies: direct causal relationships (both positive and negative between neighbours
- Transactions: including social exchanges between different members of the community such as commercial or healthcare
- Attachments or affiliations: to organisations such as cultural or sporting
- Bonds: between families and/or friends

Blokland (ibid. 211-216) remarks that social cohesion is a complex mix of the above relationships, and their multi-layered dynamics requires different thinking regarding how to improve cohesion.

Within the UK government, the Audit Commission oversaw the creation and data collection for 45 Local Quality of Life Indicators. This followed a detailed inter-government departmental exercise in 2001-02 to determine how to qualify and quantify these aspects of social life to complement the Sustainable Development Strategy (Audit Commission 2005). One area considered within these broad indicators was community cohesion and involvement, and measured the percentage of residents:

- being attacked because of their colour or ethnic origin/religion such that this is a big problem in their area
- who think community activities in their local area have improved
- who turnout for elections. (ibid.24)

The National Indicator set became effective in 2008; around 200 indicators used to assess a multitude of social, economic and environmental aspects largely until early 2011. Within the set, several indicators focused upon community cohesion issues such as:

- The percentage of people who believe people from different backgrounds get on well together in their local area
- The percentage of people who believe they belong to their area
- The percentage of people who have meaningful interactions with people from different backgrounds
- The percentage of people who feel they can influence decisions in their locality (Cohesion Institute website [Accessed Nov. 2008])

Whilst engaging with community-based focus groups and surveys may yield an 'honest' community perception of the situation, approaching the issue of assessing an improvement or decay in community cohesion could benefit from direct observation and analysis including the following aspects:

- Finding techniques to explore the *activity spaces* of sub-groups of the community
- Better comprehension of what can significantly improve cohesion
- Close analysis of past transport projects which have substantially enhanced or degraded social cohesion for lessons-learned, whilst considering the context-specific nature of past projects. (Forkenbrock et al. 2001:3-7 & 83-84).

Furthermore, many studies have found that demographic attributes (gender, age, socio-economic status, ethnic background) affect one's perception of the quality of life measures or of inequality (Brockmann et al. 2009, Crowe 2010, Dittmann and Goebel 2010).

From this small yet indicative sample of possible measures of cohesion and their caveats, it is clear that there are common concerns relating to socio-cultural mixing, empowerment and fostering a sense of attachment in the community. The section below describes how the government has sought to realise these outcomes in problem areas.

Community Cohesion: government policy initiatives

Area-based Initiatives (ABIs) were set up by national government in the late 1960s to focus on communities of social and/or economic disadvantage and carried out by regional and local partners (Lawless 2004). A pertinent initiative was the Neighbourhood Renewal Fund discussed within the urban regeneration section above. A government report entitled 'Community Cohesion Advice for those designing, developing and delivering Area Based Initiatives' (Home Office 2003) acknowledged that there was a concern that resentment arose between communities that had been selected for ABIs and therefore deemed to be improving, and those that have not. The report notes that it is important to diffuse this inter-neighbourhood frustration by providing opportunities for cross cultural contact at all levels from the beginning. Suggestions for the promotion of interaction to take place often and naturally were made, in settings such as schools, sports and other cultural events. They also suggest that 'twinning' communities can enhance trust and understanding between regenerated and non-regenerated areas, facilitated potentially by Community Empowerment

Networks and Local Strategic Partnerships (Home Office 2003:11-13). The Sustainable Communities Strategy launched in 2003 by the O.D.P.M. aimed to raise the quality of life in the community by reducing crime rates, antisocial behaviour and inequality whilst increasing prosperity and employment levels and health. The outcome was hoped to be “a diverse, vibrant and creative local culture, encouraging pride in the community and cohesion within it” (O.D.P.M. 2003:3-5). In a study of the process of urban governance regarding social engineering to improve cohesion, Van Marassing et al. (2006:287-88) considered the benefits of empowering residents to become heavily involved in the restructuring of the social fabric of their community. In their case study, community cohesion did improve between the members but often for a limited period if it involved a specific cause, but this dissipated after the cause ended if there was no long-term structure .

Sheffield Hallam University’s Centre for Regional Economic and Social Research (CRESR) is evaluating the success of the New Deal for Communities initiative, launched in 1998, in a series of papers, the first covering the impacts of the programme between 2001-2005 (O.D.P.M. 2005). They found that overall, a significant number of residents in the NDC areas were feeling more positive about their neighbourhoods, resulting in a lower population turnover. As discussed above, lower turnover is a key to improving the cohesion of a community. The second report covering the impacts and outcomes of the programme from 2005-2009 has been published (D.C.L.G. 2010c), and considers the more long-term, and spatially wider-reaching outcomes of the initiative. Of note, the greatest improvement seen in the 39 neighbourhoods transformed under the programme was said to be people’s feelings about their community, and that residents were more satisfied with their area as places to live (D.C.L.G. 2010b:4). Neither of the case-study hubs are in NDC areas.

Community cohesion and the research scope

The social, economic and physical changes that a hub experiences during the implementation and delivery of an MUTP can alter the fabric of the community in many, sometimes unintentional, ways. New residents, jobs, and transport changes, for example, could affect the community; increasing the risk of fragmentation, alienation and low cohesion. The main case study, Ebbsfleet, comprises five established communities between which a new town is being created around the station, and the potential for significant disruption to the existing residents is high. Therefore the Community Cohesion Impact indicator explores demographic and tenure diversity, levels of crime, quality of life indicators and population turnover as well as neighbourhood severance and segregation discussed in a previous sub-section. However, as with a large proportion of this study, ‘scale’ is of significance, as cohesion may well be strong, within a group of people at one spatial scale, but absent at a larger area (Brown 2001, Van Marassing et al. 2006). Indeed this could lead to problems of social exclusion of some spatially or culturally peripheral groups if there is

very concentrated cohesion (e.g. Abada et al. 2007). This element is discussed within the Community Cohesion indicator findings (chapter 7.7c) below.

This overview of possible social impacts upon community members following the implementation of an MUDP in their locale highlighted several important changes that could take place. Within a community, accessibility from supplementary transport projects (feeder buses, new pedestrianised areas, cycle routes for example) may provide improved access to employment opportunity locations, reduce transport-related social exclusion and therefore relieve deprivation for some. However accessibility is not always viable for those most in need, and the first section of this chapter sought to emphasise the need to consider sustainable accessibility for MUDP-related transport initiatives for all members of the community. The second section of this literary review considered the land-use changes that commonly take place with the delivery of an MUDP such as regeneration, redevelopment and the effects of the physical infrastructure on perceptions of community cohesion. This was helpful as differences between academic thinking and even current government proposals exist. This can be seen in, for example, the rhetoric relating benefits of regeneration including increased employment which studies e.g. Flyvbjerg (2003) and Gospodini (2005) imply that specific conditions need to exist before these are borne out. An MUDP represents such a significant influx of financial investment into an area, that step-change is likely, and as such these impacts need to be anticipated in advanced and managed well so as to take advantage of the planned initiatives and unintentional or unplanned outcomes.

The following chapter discusses the key processes for planning, appraising and evaluating transport projects in the UK. This serves to emphasise the exclusion of social impacts, discussed above, from this process and what impacts are deemed important in their place.

3. **Contextual Background: Planning, appraisal and evaluation of transport projects in the UK**

This section provides the background for the GIS indicator set output and the potential users, from central government decision-makers, regional planning bodies, to local community members. Stages of the planning, appraisal (pre-project) and evaluation (post-delivery) of an MUTP and associated transport and land-use changes are discussed. This presents a brief overview of the current government process and where and how the GIS indicator set can make a valuable contribution to promoting social equity for non-users, that is those affected by the facilities but not using them directly.

The planning framework and decision-makers

The conception of a transport project (mega or otherwise) can be convoluted and at times uncertain. This section aims to provide a brief overview of the planning control framework and the ever-changing decision-making process. A discussion of key policy statements and legislation regarding the government's position on the role of the transport systems is located within the appendix (10.1).

The planning control framework

The diversity of institutional structures combined with the tension of public and private interests along with the complexity of planning and legislative processes make delivering an MUTP a difficult challenge (Glaister and Travers 2001).

Regional and local authorities are required to produce statutory plans on a regular basis relating to amendments to land use (i.e. changes in commercial, residential, industrial uses etc.), which are reviewed by the Planning Inspector as they evolve over time and once passed, become semi-legal documents. (Terry 2009:11). Structure Plans were an outcome of the Town & Country Planning Act of 1968 and were produced by the County Council (where they existed) until 2004 and most closely followed central government policy (D.E.T.R. 1999). Local Plans were derived from the Structure Plans and produced at the District Council level and set out the local context for issues such as housing and services until 2004 (O.D.P.M. 1999).

Following closely the aims, objectives and parameters of the Local Plan, Local Transport Plans were produced every five years to enable counties (and Unitary Authorities) to:

- Establish how they will achieve sustainable and integrated transport

- Integrate with land use plans as well as relevant policy regarding education, health and the environment
- Request funding from central government for transport plans

The Kent County Council Local Transport Plan 2006-11 acknowledges the particular challenges faced by the county. These suggest that deprivation and a lack of access to a car is relatively high for the south-east of England, and that as a gateway to Europe, Kent has specific travel patterns and associated problems, including the requirements of two major growth areas (Ebbsfleet / Kent Thameside, and Ashford; the two case-study areas). Particular concerns related to accessibility include providing for an aging population in the coastal towns, and the high level of deprivation, unemployment and social exclusion experienced in some areas (K.C.C. 2006).

Regional Assemblies (RAs) together with Regional Development Agencies (RDAs) were responsible for producing regional plans that aim to better integrate transportation and other policies. Such regional plans include Regional Transport Strategies (RTS) within which the Local Transport Plans fall. The RTS aim to:

“...be consistent with national policies but they should also reflect and support the aims of the spatial strategy and the plans for housing growth and economic regeneration in the region. Spatial policies need in turn to fully recognise the importance of delivering more sustainable travel patterns and of matching locations of housing, commercial development and key services to areas of high public transport accessibility” (D.f.T. 2006a).

Regional Planning Guidance Notes (RPG) were planning framework documents produced for Government Office Regions (GORs) by the RAs from the mid-1980s, and as such, number 9 was published for south-east England (the case-study) region, including the growth of the comparison case-study Ashford as an Opportunity Area (Ch.12). A sub-document of RPG9 related to the Thames Gateway development (RPG9a, 1995 DoE), set out in detail the vision and strategy for regeneration for the corridor that includes the main case-study hub; Ebbsfleet and the role of the CTRL (fig. 3.1). RPGs were abolished in 2004.



Fig. 3.1 The Thames Gateway development area in RPG9a (1995:12)

Planning Policy Guidance were produced in order to encapsulate current thinking and approaches to government policy, and the 1998 White Paper prompted a significant revision of PPG13 (Transport) to incorporate more integrated planning between land use and transport within a sustainable framework. Within PPG13, the key objectives for national, regional, strategic and local transport planning are stipulated as the promotion of sustainable transport choices, increase in accessibility by sustainable modes and reduction of the need to travel by car where viable (D.C.L.G. 2011: Sec.4). Greater clarity is issued for Local Authorities when preparing development plans regarding regional planning bodies that integrate well with transport strategies, and local planning to improve transport provision to meet changing needs (Sec.6-11). Improving Social Inclusion is explicitly mentioned (Sec.19) as is the role of transport in encouraging city-centre over out-of-town development (Sec.20). The relationship between good urban design and better transport (Sec.28) is also considered, as are efforts to reduce the need for long-distance commuting (Sec.30) and reducing community severance (Sec.64). The PPG are gradually being replaced by Planning Policy Statements.

Following the Planning and Compulsory Purchases Act (2004), Regional Planning Guidance, Structure Plans and Local Plans were abolished in favour of Regional Spatial Strategies (RSSs), a core source of guidance for the new Local Development Frameworks (LDFs), and their associated documents and statements (fig. 3.2) (Planning Portal 2010) .

Regional Spatial Strategies were expected to:

- establish a 'spatial' vision and strategy specific to the region, for example, identifying in general terms areas for development or regeneration for a period of about 20 years ahead
- contribute to the achievement of sustainable development
- establish regionally specific policies, which are expected to add to rather than replicate national ones
- address regional or sub-regional issues that may cross county, unitary authority or district boundaries
- outline housing figures for district and unitary authorities to take forward in their local development frameworks
- establish priorities for environmental protection and enhancement, and define the 'general extent' of areas of green belt
- produce a Regional Transport Strategy as part of the wider spatial strategy
- outline key priorities for investment, particularly in infrastructure, and identify delivery mechanisms, in order to support development
- identify how the region's waste should be dealt with
- be consistent with and supportive of other regional frameworks and strategies. (D.C.L.G. 2004, D.C.L.G. 2010d)

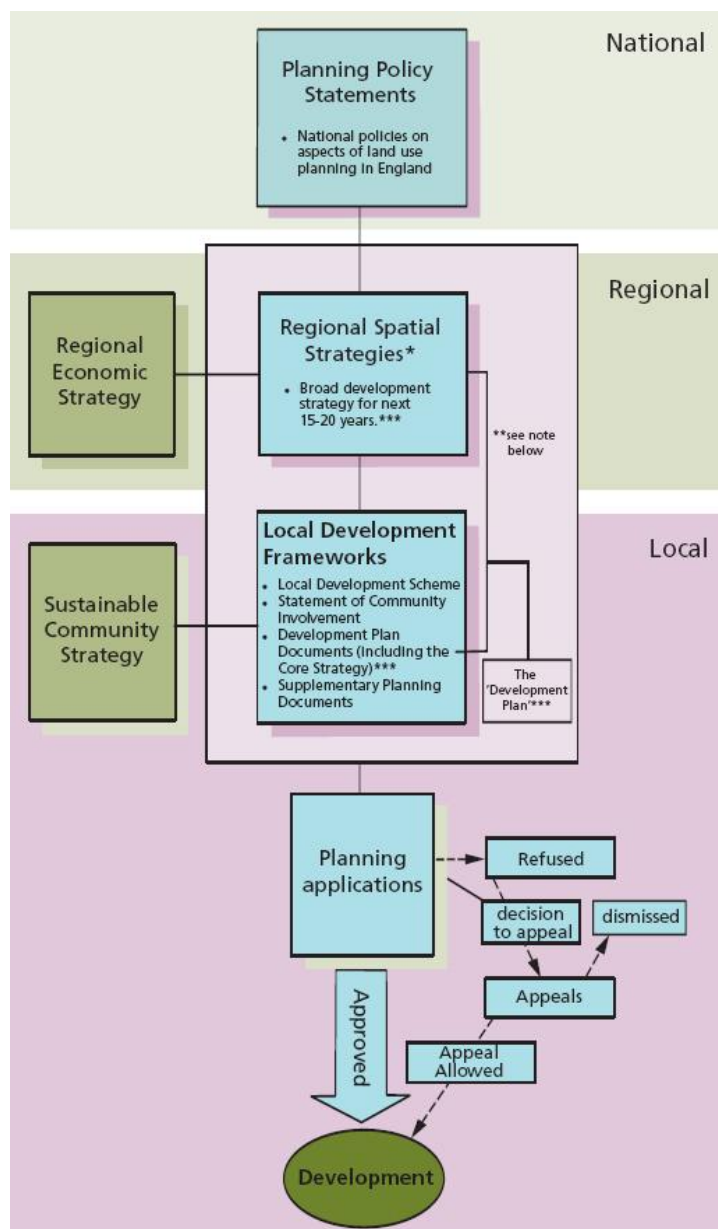


Fig 3.2: How the existing planning system works at local, regional and national level (D.C.L.G. 2007b:6)

Detractors from the RSS process cited excessive complexity and time taken to prepare and execute the plans (D.C.L.G Committee 2010-11). However, there is unease regarding their current proposed abolition in the Localism Bill (2011), felt by some to result in a strategic-level policy vacuum (D.C.L.G Committee 2010-11, R.T.P.I. 2011). There is no clear indication of how Regional Transport Strategies will instead be produced following the abolition of the RSS (D.C.L.G. 2010a: Sec.21).

The National Infrastructure Plan (H.M Treasury 2010) sets out strategy for the role of transport in developing a competitive economy, contributing towards sustainable economic growth, tackling climate change and promoting greater localism and the level of investment required to achieve those goals (Section 4(b)).

Terry (2009:14-15) argues that MUTPs should be planned as *regional* projects; their socio-economic impacts occur at this level and are often funded from public finance, but regional government often has not had the power to plan and deliver these. With the imminent loss of some levels of regional planning, the promoters of HighSpeed2 argue that local decision-making capacity will be insufficient and that national government will have to intervene (Booz and Temple 2011: Sec.6.4.10).

Finally, Passenger Transport Authorities (PTAs), subsequently called Integrated Transport Authorities (ITAs) since 2008, are responsible for the planning of integrated transport in six major urban conurbations since their creation in the late 1960s following the Transport Act 1968, whilst Passenger Transport Executives (PTEs) were tasked with the finer details of everyday running of the system (White 2009:3-4). The Local Transport Act strengthened the position of the ITAs regarding the regulation of bus provision, and also made them the single transport planning authority for their region (2008 c.26 Part 5 c.1&2). However no ITA or PTE are in force in the case-study areas. The previous government had published the Major Transport Schemes Guidance for Local Authorities. However since the new coalition government spending cuts, an interim guidance note stipulates that major schemes are currently unlikely to be allocated funding in the current spending climate and that unless some level of planning consent had been granted, that such work be suspended indefinitely (D.f.T. 2010b). In his concluding remarks Terry notes that transportation is awkwardly accommodated within current planning, legislation and public finance framework and does not acknowledge the unique position transport holds in the local and national economy (Terry 2009).

Decision-making process for MUTPs

In Britain, the planning system described above is essentially regulatory. If a major transport project requires planning approval, Ministerial consent or a separate Act of Parliament is required, or the Local Authority needs to obtain planning approval in much the same way as the private sector, who are most often the promoters of such schemes (Terry 2009:14).

Planning approval could be formed as part of an Order made by the Secretary of State under the Transport and Works Act (1992). This Act intended to simplify the process of approval for railways, tramways and other guided transport system projects that were relatively small to medium-scale that previously required a Private Bill (i.e. affecting only a select number of organisations). It allowed the Secretary of State on behalf of government to approve transport projects that in their opinion were not of 'national significance' (parameters not specified) in order to free up parliamentary time and remove the burden from MPs having to digest highly technical documents (Butcher 2010b). Furthermore the consultation process was decentralised making it easier for objectors to attend relevant meetings in the locality. Unlike smaller projects, MUTPs have not benefited in time and cost savings through the

Transport and Works Act (TWA) procedures, but still incur delays mostly as a result of administrative issues related to the civil service (Terry 2009:18). There are some instances where a public inquiry is called to debate relevant issues raised by a planning application to a local authority before the Planning Inspectorate makes a final decision, which is only modifiable by the Secretary of State. The Planning Inspectorate is also charged with examining Development Plan documents and reporting upon any plans that the D.C.L.G. have called in for a decision (Planning Inspectorate 2004).

If the project is deemed to be of 'national importance', an individual Act of Parliament is often required. MUTPs can also seek approval through the Private Bill or a so-called Hybrid Bill (a mixture of Public and Private) created through Parliament where there are mostly elements that would conform to a Private Bill but require closer integration with general legislation (House of Commons 2010). High-Speed 1 / CTRL (the case study MUTP) rail link was granted as a Hybrid Bill (CTRL Act 1996), as was Crossrail some years later (Crossrail Act 2008). However the application for the CTRL station at Stratford was considered as a TWA order (House of Commons 2010:4).

"Few countries have ended up with a planning system that manages to hold up projects for decades and to give people the feeling that they don't have any say at all" (Tony Travers, LSE, regarding the Heathrow T5 process. Reported in The Economist Nov. 2001).

The myriad of British institutions involved with the planning of MUTPs and an absence of an overall body to co-ordinate matters is seen as a major issue, which projects such as Crossrail are believed to have suffered (Glaister and Travers 2001). The length of time and cost involved in seeking approval for MUTPs was acknowledged to be excessive, and to rectify this, the government responded by the formation of an Infrastructure Planning Commission following the Planning Act (2008). They were to oversee the planning approvals of Nationally Significant Infrastructure Projects (NSIPs) including transport, energy production and waste. These were anticipated to bring fresh approaches to community engagement, along with the employment of independent 'expert' decision-makers and new streamlined inquiry procedures (Infrastructure Planning Commission 2011). Despite these goals, there was a general impression that the IPC was still too complex, time-inefficient and undemocratic (Davoudi 2011, Hewitson 2011). This was possibly due in part to financial uncertainty, the lack of formally adopted National Policy Statements to inform the decisions of the IPC, and the unfamiliarity of this new process (ibid.).

In light of these concerns, proposals within the draft Localism Bill 2011 include:

- Abolishing the Infrastructure Planning Commission (and the creation of a Major infrastructure Planning Unit within the Planning Inspectorate) and a return to a position where the Secretary of State takes the final decision on major infrastructure proposals of national importance
- Providing for Neighbourhood Plans, which would be approved if they received 50% of the votes cast in a referendum

- Providing for Neighbourhood Development Orders to allow communities to approve development without requiring normal planning consent (www.parliament.uk 2010-11)

These proposed measures will undoubtedly swing the balance of power of decision-making for many issues covered within the impact indicator set, not least the increasing strength of community opinion, hence the benefit of producing an indicator set with clarity and transparency of data outputs.

Planning of MUTPs and the research scope

The complex nature of the planning route for MUTPs implies that there are many planners, decision-makers and stakeholders with variable levels of power and remits who consider different aspects of a project at different stages. The driving force behind the planning of an MUTP is political and economic, the social impacts peripheral and largely incidental at this stage. However the GIS-based indicator set provides the basic information regarding areas where the MUTP can add social benefits to the community, and where there are potential risks, plans can incorporate mitigating intervention strategies.

The transport project appraisal framework

Transport appraisals are utilised when the decision to undertake a project is made, and is to provide decision-makers with evidence as to the project's impact and viability, and the direction in which it ought to be implemented (D.f.T. 2011b:1.1.2). Processes for appraisals will vary greatly depending upon the nature and scale of the decision-making organisation (at the local, regional or national level). MUTPs in particular require a large quantity of background information, inputs from many stakeholders and many time-consuming stages of the appraisal process. There are several fundamental choices to make, such as whether or not the project goes ahead, the general conceptual applicability of the general design, the specifics of the location and finer details. (Dimitriou et al. 2010:17).

The key objectives to meet are assessed via set criteria, although the selection of objectives and criteria are rather subjective (Dimitriou et al. 2010:18). This section provides a brief introduction to the two main appraisal techniques; cost-benefit analysis and multicriteria analysis, and a closer look at the current appraisal process in government. Greater attention is given to the inclusion of social aspects in relation to the aims of this research.

Cost benefit analysis (CBA)

During the 1960s, cost benefit analysis (CBA) was introduced to British transport appraisal methods with the aim of providing a single valuation using the complete monetisation of non-cost aspects of the transport project, in order to maximise net benefit expressed as 'Benefit:Cost' ratio (Dimitriou et al. 2010:17-19). The valuation is based upon the 'willingness-to-pay' or 'willingness-to-accept' theory for the potential winners and losers of the project's impacts, and a project is considered acceptable if the benefits outweigh the

costs over time (D.C.L.G. 2009:15). Methods utilised to create the monetisation values by either observable price changes or indirectly using widely accepted techniques are the subject of a great deal of research (see Prest and Turvey 1965, Layard and Glaister 1994, Mishan and Quah 2007 for example) but are not directly relevant here. Some common issues include the problem of capturing all the relevant potential costs and benefits without double counting the impacts, or conversely the combined effects of impacts that are considered separately. Also it clearly is not practicable to place a monetary value on all potential impacts, including the effect of a project on social cohesion (D.C.L.G. 2009:17). Also, it is hard to overcome the issue of accurately quantifying an issue that is a cost to one group when a benefit to another, e.g. large vehicle occupants vs. cyclists and pedestrians (Browne and Ryan 2011). There are further critiques concerning the use of cost-benefit analysis in decision-making (transport or otherwise), such as those by Elvik (2001), Hahn and Sunstein (2002), Tedula et al. (2006) or Sudiana (2010).

Multicriteria Analysis (MCA)

Much wider ranging than CBA, MCA seeks to consider monetised and non-monetised benefits and costs expressed in both quantitative and qualitative contexts. With the aim of providing a more transparent and flexible approach to transport appraisal, all the perceived potential impacts are produced in a table, enabling decision-makers to consider each cost and benefit (Dimitriou et al. 2010:18). The conceptual strengths of MCA over CBA is the recognition that there are important yet hard-to-value environmental impacts as a result of transport infrastructure (D.C.L.G. 2009:18). There are several MCA methodologies, differing in the way in which they combine data and apply weighting schemes, and can be adopted to select the most preferable options, rank options, create a preferred sub-group or highlight non-viable options (D.C.L.G. 2009:19). Stirling (1997) developed a software tool for 'Multicriteria Mapping', an interactive appraisal process to explore a range of views via stakeholder interviews to map the potential implications of different choices made in proposed strategic and policy interventions (MulticriteriaMapping 2009). This technique has been adopted for several processes: energy strategies (Stirling 1997, McDowall and Eames 2006), environmental policy consultations (Clark et al. 2001) and a framework for policy analysis (Burgess et al. 2007), but not in transport scheme appraisal as yet. One recent study proposed the combination of CBA with MCA and Decision Support Systems for large transport appraisals. They conclude that their approach responds to a common problem of pure-CBA appraisals, a systematic review of non-costed values and the ability to weigh up aspects that can make a project go from non-viable to attractive (Barfod et al. 2011).

The transport appraisal process in England

'The Green Book: Appraisal and Evaluation in Central Government' (H.M. Treasury 2003) was published to form a holistic best practice guide for the appraisal and evaluation of policy and projects by central government (D.f.T. 2011b:unit 2.7.1). The process described within

the Green Book begins with identifying the rationale for transport intervention, to the establishment of outcome goals, appraisal of the potential solutions for the implementation and ends with suggestions for monitoring and evaluation (ibid.). Two key questions when initially considering a transport projects are posed; are there better ways to achieve the aims or objectives? And, does it provide value for money? (D.f.T. 2011b: unit 1.1).

Since the publication of the 1998 White Paper 'A new deal for transport, better for everyone' (D.E.T.R. 1998) the then Department for the Environment, Transport and the Regions, and now the Department for Transport have employed the 'New Approach To Appraisal (NATA)', adopted by all tiers of transport project decision-making including Local and Regional Transport Plans, programmes and projects, and the Strategic Rail Authority's Appraisal Criteria. Principles of 'economic' (which includes social, environmental and financial) appraisal and evaluation from the Green Book are inherent in NATA's methodology (D.f.T. 2011b:unit 2.7.1.1.2).

There are five general areas related to government policy that are assessed in NATA:

- Economy (Public Accounts, Transport Economic Efficiency: Business Users & Transport Providers, Transport Economic Efficiency: Consumers, Reliability, Wider Economic Impacts)
- Safety (Accidents, Security)
- Environment (Noise, Local Air Quality, Greenhouse Gases, Landscape, Townscape, Heritage of Historic Resources, Biodiversity, Water Environment, Physical Fitness, Journey Ambience)
- Accessibility (Option values, Severance, Access to the Transport System)
- Integration (Transport Interchange, Land-Use Policy, Other Government Policies). (WebTAG unit 3.2.1.2.3)

These are assessed and summarised in a single Appraisal Summary Table (AST), although there is acknowledgement that some themes are still not optimally valued, such as landscape, biodiversity and heritage (D.f.T. 2011b:unit 2.7.1.2.4). However, of the themes above, accessibility and its sub-themes - severance and transport access – are also considered by the GIS-based impact indicator set. Discussed in WebTAG, the D.F.T.'s online transport analysis guidance portal, these three issues have set parameters for inclusion in the appraisal process.

Accessibility is assessed within TAG unit 3.6, and based on Ch.7 (Sec. 2) of the Guidance on the Methodology for Multi-Modal Studies (GOMMMS) (D.E.T.R. 2000). The unit puts forward the methodology for considering appraising the value of the 'option' for an individual to use a transport service, even if they do not use that mode or service. The accessibility measure is generally a cumulative contour map regarding travel times and reachable opportunities for certain demographics, with the use of GIS described in detail (WebTAG unit 3.6.3.2.2).

The treatment of severance in appraisal methods is described in TAG 3.2.6 (D.f.T. 2011b) and shares much with the Community Severance Impact study for D.F.T. previously discussed (D.f.T. 2005). C.F.I.T. commented in 2004 that although severance was an acknowledged negative impact of some projects, its effect was hardly ever incorporated into appraisals (C.f.I.T. 2004: Appendix Table A2) supported by the D.F.T. in the NATA Refresh exercise (D.f.T. 2009d:12-13). Within unit 3.2.6.1.1.9, severance from rail systems on dedicated tracks, assessment is recommended (beyond standard road severance appraisals) to include the time taken and frequency of level crossings for pedestrians and also an appraisal of earthworks/banks and disused railway lines.

Not explicitly presented in the NATA approach until very recently were Social Impact Assessments (SIAs). One comprehensive definition comes from Burdge and Vanclay (1996:59):

“Social impact assessment can be defined as the process of assessing or estimating in advance, the social consequences that are likely to follow from specific policy actions or project development, particularly in the context of appropriate national, (regional or local) environmental policy legislation. Social impacts include all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs, and generally cope as members of society. Cultural impacts involve changes to the norms, values, and beliefs of individuals that guide and rationalise their cognition of themselves and their society”.

Vanclay (2003) also provides a comprehensive overview of international principles for Social Impact Assessments. This form of impact assessment is not restricted to transport policy changes or projects (See Egge and Senecal 2003, Rossouw and Malan 2007 for examples of dam projects, Lockie 2009 for mining, and O'Faircheallaigh 2009 for Aboriginal-related policy interventions), but the process for carrying an SIA out is similar for any context:

- understanding, managing, and controlling change
- predicting probable impacts from change strategies or development projects that are to be implemented
- identifying, developing, and implementing mitigation strategies in order to minimize potential social impacts (that is, identified social impacts that would occur if no mitigation strategies were to be implemented)
- developing and implementing monitoring programs to identify unanticipated social impacts that may develop as a result of the social change
- developing and implementing mitigation mechanisms to deal with unexpected impacts as they develop
- evaluating social impacts caused by earlier developments, projects, technological change, specific technology, and government policy. (Burdge and Vanclay 1996:60)

The benefits of carrying out an SIA, particularly with the involvement of the local community are great. The reduction of local resistance, compensation and perceived negative socio-cultural effects of a project are well noted, hence save money for the private and public sector in the long-term (Burdge and Vanclay 1996:61). There are issues associated with the SIA process; notably the lack of standards and consistency in data collection, shortcomings in theoretical grounding (based on critical, discursive sociological theory) which do not

provide explanatory interpretations, and the lack of independent auditing or evaluation of reports by private consultancies who carry out SIAs (Burdge and Vanclay 1996:66-67). Of greater concern, Burdge and Vanclay remark (1996:69) that there is a general lack of recognition by decision-makers, politicians and planners of the importance of socio-cultural change following policy or infrastructure changes compared to economic or environmental impacts. Further consideration needs to be given to a number of relevant issues, such as:

- How can the impacted community members be identified? With so much change following the infrastructure project, capturing the opinions of those most affected is difficult
- How could the community participate meaningfully in the SIA process? Given that such large changes are highly emotive, how does the assessment adopt their opinions meaningfully into the decision-making process?
- How to select impacts to be considered and their weighting? Different people within a community can have variable reactions to the same catalyst or the same person over time. (Burdge 2004)

Esteves and Vanclay (2009) propose the addition of a Social Development Needs Analysis to enhance the effectiveness of SIAs in the appraisal process. This entails identifying the scope of social issues already present in a community so that the incoming project or policy can contribute positively to improving the social contexts of the residents, i.e. a corporate social investment, a shift from pure impact mitigation.

Atkins (2009) produced a report proposing the future inclusion of social and distributional impacts in the UK appraisal process for the Department for Transport. This was part of the NATA Refresh exercise, which sought to incorporate findings from the Stern (2006), Eddington (2006) and Barker (2004 & 2006) reviews. In addition the Atkins report includes advice regarding how to collect impact data and what barriers exist to incorporating them into current appraisals. The report suggests eight potential social impacts to be included: distribution of noise impacts, distribution of air-quality impacts, accessibility, severance, affordability, distribution of user benefits, personal safety and road safety (Atkins 2009:12-15). The results of the pilot study were published recently (Atkins 2010:29-36), and conclude that some people are more vulnerable to the negative impacts of transport. Guidance for measuring such impacts needs to be flexible, and consideration needs to be given to reducing the negative impact by redesign of the transport project. Their suggestions for improving accessibility in NATA include taking a greater consideration of how this can impact upon social exclusion for different social groups, the need to go beyond simply considering average journey times and travel costs and the exploration of actual potential destinations. A close contextual understanding of complex transport need issues is required to offer a genuine impression of the transport options (Atkins 2010:85-87). Quantification is the percentage change of people (with and without cars considered separately) who benefit from the transport intervention (Atkins 2010:91). For new severance measures, similar closer assessments of 'at-risk' populations such as the elderly, children, disabled and no car households (at Output Area level assessment), and the level of disruption by foot to several local services (e.g. GP, churches and playgrounds) are required (Atkins 2010:81-83). The

quantification used is a score relating to the change in severance (from severely negative to largely positive) multiplied by the band categorising the number of different social groups of people affected (Atkins 2010:84). Compared to the suggestions of Social Impact Assessments above (e.g. Burdge and Vanclay 1996), there is very little mention of the potential for community involvement. This new approach has now been incorporated into NATA (Unit 3.17) in April 2011, including supplementary resources regarding demographic profiling for identifying vulnerable groups (e.g. TAG unit 3.6.2.3 for severance issues).

The recent publication of a House of Commons Transport Committee review 'Transport and the economy' (2011) noted some criticism of NATA by MPs, the RTPI and the Transport Planning Society. These include; the lack of comprehensive Wider Economic Impacts (WEIs), no inclusion of regeneration impacts and regional imbalance redress, too low CO₂ calculations and the 'black-box' nature of the technical process with a lack of data input transparency (Transport Committee 2011:Ch.4, Sec.80).

In late April 2011, the Government announced a new transport appraisal approach that will now consider if schemes:

- are supported by a robust case for change that fits with wider public policy objectives; the 'strategic case';
- demonstrate value for money – the 'economic case';
- are commercially viable – the 'commercial case';
- are financially affordable – the 'financial case'; and
- are achievable – the 'management case'. (D.f.T. 2011a)

These new components will supersede the NATA process. Christian Wolmar, a transport commentator remarked in his online blog (May 2011) that railway schemes were not likely to succeed within these parameters compared to the business case for road schemes. This was a concern voiced by Banister and Thurstain-Goodwin (2011:212-13) even prior to this recent announcement. Furthermore it is not yet clear how the new social and distributional impacts recently incorporated within NATA above will be weighted compared to these elements.

Transport Appraisal and the research scope

At the commencement of this study (2006) there was no explicit evaluation of social impacts for non-users of transport projects in the appraisal process, although this was gradually changing (Atkins 2010:0.15). Within the proposals by Atkins, some of their chosen social impacts are different to the ones presented below, although there is some overlap (accessibility and severance), as is the use of GIS as a tool for some measures (Atkins 2010:3.88). The GIS-based impact indicator set aims to be of use in the appraisal stage of an MUP for the reasons also stipulated by the community of practice for Social Impact Assessments; promoting better social equity following infrastructure changes.

Transport project evaluation and impact assessments

Considering how and if a transport project has achieved a set of objectives as proposed within the appraisal process is often highly subjective and hard to ascertain, particularly the longer the transport project has been in the planning and implementation stages. This section provides a brief overview of current government guidelines for evaluation including more focused advice by the Department of Transport. This is followed by a discussion regarding issues of evaluations pertaining to MUTPs and the section closes with a sample of evaluations of transport schemes of various modes.

How are transport projects currently evaluated?

The most recent edition of the 'Magenta Book: Guidance for Evaluation' published by H.M. Treasury (April 2011 3rd Ed.) is the current advice regarding the creation of evaluation procedures for central and local Government, charities and the voluntary sector; anyone who is involved in shaping policy. Key elements discussed within the Magenta Book cover topics such as the benefits of evaluation in an intervention, as well as more detailed steps regarding the planning and implementation of an evaluation exercise, the relative strengths and weaknesses of evaluation research designs, and how to interpret and incorporate evaluation outcomes into future work. Supplementary guidance is offered regarding statistical approaches and sampling, and how to carry out qualitative evaluation exercises including in-depth interviews, focus groups and discourse analysis (G.S.R 2007).

The Department for Transport has issued related guidance for the D.f.T., local authorities and other evaluators of transport projects and they endeavour to incorporate lessons-learned back into future policy making and transport appraisal (D.f.T. 2010a). Their specialised guidance report 'Guidance for transport impact evaluations: choosing an evaluation approach to achieve better attribution' was developed by the Tavistock Institute and AECOM. Within, there are six steps proposed so as to understand if the anticipated benefits have come to fruition, what (if any) unintentional consequences are of the project and to clarify if the project was value for money subsequent to delivery (Tavistock Institute 2010:3). Given the variability in project contexts, the differing types of project and the complexity surrounding isolating 'true' impacts of a project, the guidance is intended to provide a flexible iterative framework to design the most appropriate evaluation for that intervention and the requirements of the appraisal (ibid.) (fig. 3.3).

The first of the six steps requires the evaluator to identify the objectives of the transport intervention, the users of the evaluation, and the resources (personnel and financial) to produce an evaluation as these all influence the shape of the process (Tavistock Institute 2010:13-14). The second step suggested seeks to clarify the type of intervention that is being evaluated, i.e. a programme, scheme, package or a policy as these will vary the details of the evaluation (Tavistock Institute 2010:15-22).

Step three is concerned with deciding the evaluation focus and related questions by a processes called 'mapping the intervention logic', which entails linking together the key components of the intervention; i.e. the activities, the outcomes (short-medium term results) and impacts (long-term results) (Tavistock Institute 2010:23-27).

Step four draws from the previous steps to finalise the purpose and relevant questions for the evaluation by ascertaining if the evaluation is knowledge-based (i.e. seeking understanding why some interventions work for lessons-learnt), or accountability-based (i.e. if intended benefits from the appraisal have taken place; observing and measuring changes). Typical question styles that feed into these two evaluation types are causal, critical, explanatory, descriptive or normative (Tavistock Institute 2010:28-32).

The fifth step is the selection of an evaluation approach from three proposed options. These are the 'outcome approach'; a before and after intervention comparison, the 'experimental approach'; an intervention and non-intervention (control) population comparison, and the 'theory approach' which specifies and then gathers data regarding hypothetical intervention impacts. The evaluation purpose and questions, attribution data and type of transport intervention will help in choosing the most suitable approach (Tavistock Institute 2010:51).

The final step aims to guide the evaluator as to how to gather attributive data to support the evaluation approach. This can include random, quasi-experimental designs or the appropriation of Realist Evaluation or Theory of Change approaches. Some evaluation needs can benefit from a combination of approaches. For example, a generally experimental methodology could utilise a theory-based approach to clarify findings that robustly assess the extent to which the intervention changed the context and furthermore provide an explanatory framework for these changes (Tavistock Institute 2010:52-67).

From the two major government sources of evaluation exercise guidance above, it is clear that due to the highly contextual nature of transport intervention, no specific criteria or indicators are offered as standardised key performance indicators or measures of success. It would be reasonable to expect that there was/is inevitably some subjectivity in choosing evaluation questions, which cannot be easily overcome, discussed in the section below.

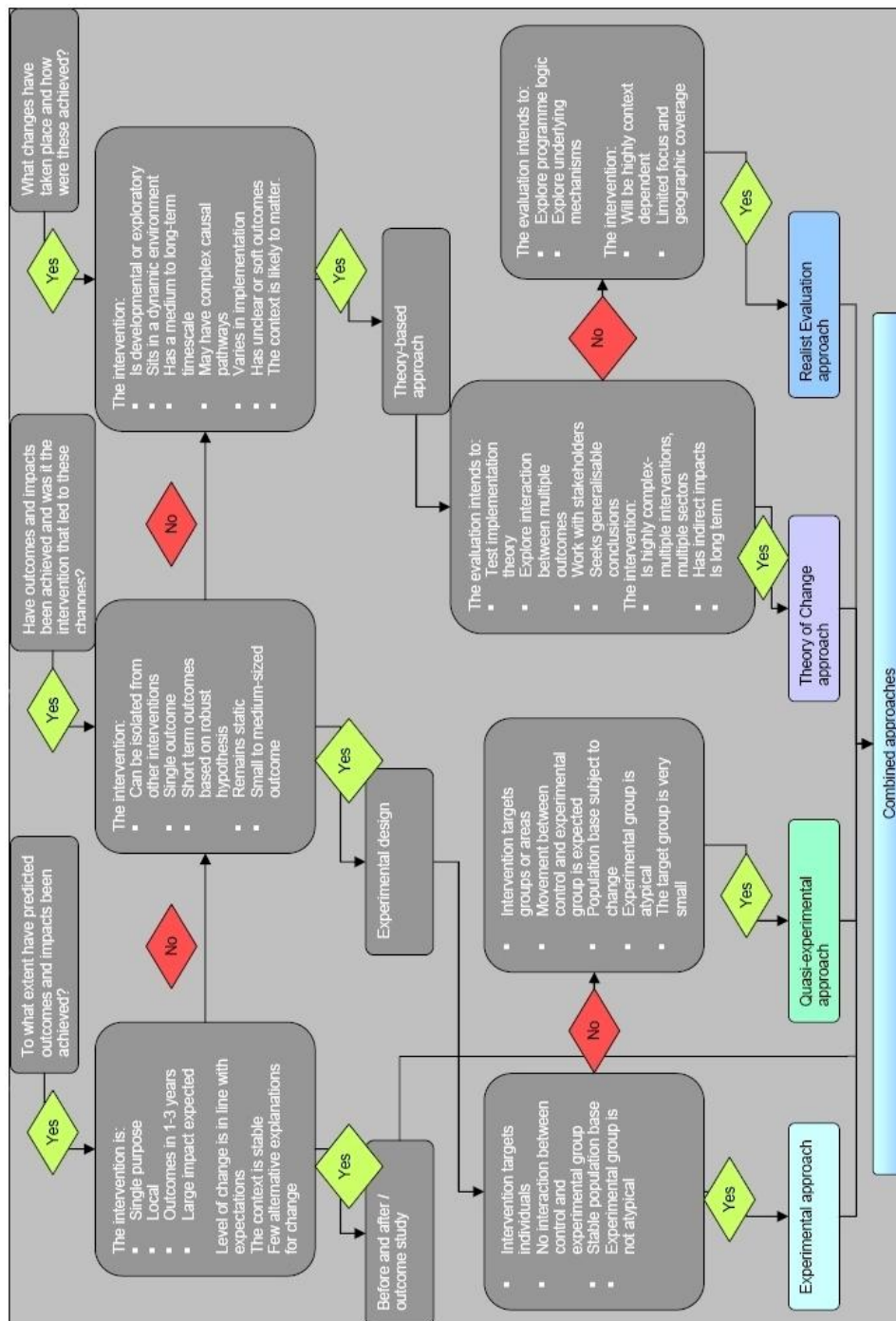


Fig. 3.3: D.F.T. and Tavistock Transport Evaluation Guidance (D.f.T. 2010b:70)

Shortcomings regarding the MUTP evaluation process

Central to the Omega Centre's research agenda is the question 'what constitutes a 'successful' MUTP?'. Traditional narrow appraisal and evaluation procedures have focused heavily on engineering, economic and financial aspects of project development, and neglected to incorporate sufficient insight into the economic, social and spatial outcomes (Omega Centre 2007a). Given the exceptionally long-time frame, complexity of stakeholders and financial structure as well as the changing socio-political context, MUTPs are particularly

awkward to evaluate. Samset (2008) considers it to be highly problematic to attempt to align the initial objectives of a mega project with realistic outcomes and therefore it is futile to adopt these objectives to measure the success of the project. There can also be a conflict between the aims and objectives accepted as valid reasons for the project to go ahead regarding a government's agenda, and the benefits presented to impacted communities or the wider population at a subsequent time (Orueta and Fainstein 2008). This supports Dimitriou et al.'s suggestion (2008) that the ever-changing value systems of successive governments affect the expectations of what an MUTP can and ought to deliver, absorbing emerging issues such as climate change and sustainability concerns. For many years, project efficiency measures have dominated project evaluations; the so-called 'iron triangle' of cost (within budget), time (completed by the deadline) and quality (correct specifications) (Ogunlana and Toor 2010:229). These are clearly very limited criteria and Samset (2008:175) suggests in addition to these are several other measures, rooted in construction management, which are supported by the UN, OECD and EC;

- Project efficiency: completion within the pre-determined budget and time-frame
- Effectiveness: the completion of initial objectives at the appraisal
- Impact: bearing limited net negative consequences
- Relevance: being able to respond to the priorities and needs of the society
- Sustainability: related long-term outcomes are beneficial

Further potential indicators could be:

- Life cycle issues: energy consumption and maintenance requirements
- Satisfaction: for both users and non-users
- Free from defects: quality of workmanship. (Pinto and Slevin 1988, Bryde and Brown 2008, Ogunlana and Toor 2010)

Some key transport project impact assessment and evaluations in the last 10 years

A brief note is needed to clarify the subtle differences between impact assessment and evaluations. The former implies a focus on measuring or observing parameters of change before and after, whilst the latter, an evaluation, brings together evidence to draw a conclusion related to the effectiveness of an action [www.dictionary.com]. However in actual transport project studies, 'impact assessment' and 'evaluation' seem interchangeable and these definitions are fuzzy. Indeed, relating to the Tavistock Institute guidance above, 'impact assessment' seems closely tied to 'accountability-based evaluations', whilst an evaluation is much like the 'knowledge-based evaluation' (Tavistock Institute 2010:28-29). Therefore seven post-implementation impact assessments / evaluations of transport projects are considered from different spatio-temporal contexts in order to provide a sample of outcomes and effects that have been chosen as evaluation criteria or indicators.

Mode	Country	Transport project	Indicators for assessment	Evaluation tool	Impacts	Ref.
High-speed rail	Italy	Milan-Verona link	Accessibility	Spatial interaction model	changes in urban hierarchy, new job opportunities, changes in demand for housing and associated services. Modal shift (freight & passengers) to road/train mix or train only was significant	1
High-speed rail	S. Korea	Seoul-Busan link	Reasons for low usage	GIS, ANOVA & user interviews	poor access to stations, expensive fares, scheduling issues, unsatisfactory travel time savings, safety concerns	2
Metro	UK	Jubilee Line Extn	Reduction of Thames as a social and physical boundary	Demographic data of local residents interviewed before and after construction. Principle Component Analysis	Opinions on less traffic, less crime, more shops, better air quality, more jobs, character of the area damaged, or more lively, less isolated	3
Metro	Spain	Madrid Metro line 12 (MetroSur)	Firm location	GIS: kernel surfaces & multinomial logit model	Patterns of activity locations are related to urban accessibility, street density and firm type. Agglomeration (economies of scale) important	4
Bus	Europe	Demand-Responsive services	Economic viability, service provision, technical performance	Questionnaires, focus groups, automated and manually observed data	Passenger numbers could be higher, critical mass is important for viability and service efficiency. Institutional, legal and economic barriers to expanding the services	5
Walking	UK	Walking bus for school children	Social outcomes	Questionnaires for children and parents, school head	more exercise, enjoyment of walking, independence of children, poor weather, loss of flexible time, embarrassment, reduced car traffic, increased sense of community	6
Walk/Bus	Columbia	Bogota Transmilenio Bus Rapid Transit	Walking accessibility to BRT increases house prices	Multiple regression analysis through a hedonic model (socio-economically stratified housing data)	Affordability issues and location of the BRT on main transport route meant low income houses <10m walk from stops did not see the property price increase seen for middle income housing	7
Sustainable modes	UK	car pools, cycle training, school travel plans, parking restrictions	Govt strategic sustainability goals (no framework)	Local Authority reported evidence	tackling climate change, supporting economic goals, better security safety and health, quality of life, equality of opportunity	8
Road	UK	Major road schemes	How well met pre-project objectives	NATA	Journey times, changes in traffic flows, accident rates, CO2 emissions	9

Fig. 3.4 Summary table of a variety of post-project evaluations

references:

1. Tira et al. (2002), 2. Chang and Lee (2007), 3. Gatersleben et al. (2007), 4. Mejia-Dorantes et al. (In press (2011)) 5. Mageean and Nelson (2003), 6. Mackett et al. (2003, and 2005), 7. Munoz-Raskin (2010), 8. D.F.T. (2009c), 9 Highways Agency (2011).

The summary table above (fig. 3.4) serves to illustrate the variety in post-delivery project impact assessment possible for different (inter)urban transport modes. Some have a strong social interest (e.g. Mackett et al. (2003) and Gatersleben et al. (2007)) concerned with the improvement in welfare and contentment of individuals and the community. Others consider a mix of social and economic elements, such as the studies by Chang and Lee (2007), Munoz-Raskin (2010) and the D.F.T. (2009a), whereby the economic indicators have a close link to social issues (house prices, affordability etc). Some impact assessment have are interested in understanding the economic impact of the transport project at a larger spatial scale, such as regional housing demand levels and urban hierarchy (e.g. Tira et al. (2002) and Lucia Mejia-Dorantes et al. (in press 2011)). Another significant group of impact assessments explore the operational success or shortcomings of the project, with performance related indicators (such as Mageean and Nelson (2003) or Highways Agency (2011)). Many include environmental aspects to varying extents, such as CO₂ emissions, traffic/congestion levels and noise levels. The studies cited above, and others, very often emphasise the contextual nature of their findings and caution against reappropriating their conclusions to another context. Political, socio-cultural, and physical configurations of the urban landscape play a strong part in the specific details of many of the impact outcomes, although performance-related studies can be a basis for good practice. From the two examples of high-speed rail link assessments described above (one in Italy, one in South Korea), it is likely that their impacts would not have any direct bearing upon the case-study MUTP in this country. Similarly the outputs from the indicator set are likely to be limited to the hubs in the first instance, although depending upon the complexity of the social impact, lessons could still be learnt for decision-makers and planners of other MUTPs.

Transport evaluation and the research scope

Although there is guidance from government for developing transport project evaluations, the criteria measured can vary greatly, as seen by the sample of project impact assessments above, relying upon the objectives of the study. Attribution is nearly impossible for some of the 'impacts' under study in the GIS indicator set, although the MUTP is likely to have had an effect. The output from the indicator set is aligned more with an 'impact assessment' (cf. accountability-based evaluations Tavistock Institute 2010) to monitor change and prepare to manage any emerging negative outcomes.

This chapter reviewed the current planning system, appraisal framework and evaluation processes associated with MUTPs. The indicator set is proposed to help in the planning stages by providing an overview of the social profile of the community so that the MUTP can be implemented with maximum social equity to all, and minimal disbenefits as a goal from the outset. At present, the complicated planning system has many tiers of decision-making with a variety of agendas and remits, and the highest levels of decision-making currently overlook non-user social effects of the MUTP in these early stages. This indicator set could

provide the local planning level with a coherent overview of the social needs of the community so as to manage the benefits an MUDP could bring. The indicator set can be of use in the appraisal process by providing supplementary value to a project that may not appear viable if considered solely as a business case. This chapter highlighted the data collected for the appraisal system was vastly biased towards the economic case. However, the creation of the appraisal of social distributive effects within NATA in April this year (2011) is a welcome step in re-addressing this imbalance, which this indicator set could further enhance. Finally the indicator set could form a part of the evaluation process by repeating the creation of the social profile and assessing the changes over time. This chapter emphasised how subjective transport evaluations are given the wide scope of contexts and requirements for post-delivery assessment. This indicator set would therefore present an articulate framework for evaluating the changes at various time periods during and following the delivery of the MUDP. Due to the use of nationally available secondary-source datasets, it would be possible to reappropriate this framework in any geographical context in England. Therefore where this chapter highlighted the absence of any standardisation in project evaluations either through time, geographical context or across modes, this indicator set is repeatable. Further discussion regarding the implementation of the indicator set is provided in the conclusion (chapter 8).

Summary of the selection choice for the final indicator set inputs

Below is a brief discussion regarding the rationale behind the final choice for indicators. A revision of the literature within chapters 2 and 3 has provided ample arguments for an indicator set that will prove useful to local and strategic planners and national decision-makers in terms of assuring that an MUDP does not merely serve national interests at the expense of local community life. With reference to fig. 2.1, at the commencement of chapter 2, the variables that were selected for the indicator set can be perceived as having interwoven relationships, impacting upon one another. None occur in isolation and the relationships are complex, fluid and often unpredictable, discussed in greater depth in chapter 6, the interpretive framework.

A summary of the indicators and their associated sub-indicators along with the reasoning behind the choice is provided initially in fig. 3.5 below.

Main indicator set inputs	sub-indicators	Rationale from the contextual background
Demographic Profiles	Index of Diversity	The relatively rapid influx of a new population attracted to the hub following the MUTP delivery can sometimes cause tension with an existing population or can reduce population turnover
Socio-economic Deprivation	Index of Multiple Deprivation Geographical Barriers	Whilst there could be a plethora of policy initiatives regarding reducing deprivation, this is often cited as an important aspiration with the regeneration of a hub alongside an MUTP
Accessibility	Transport Needs Index Potential Gravity measure	Feeder services for the MUTP and other transport infrastructure changes could provide non-users a valuable new opportunity to access services and facilities including job locations, and reduce social exclusion
Physical Barriers	Neighbourhood Division Spatial Confinement Community Segregation Impacted Access	The impact of the physical infrastructure of the MUTP can be profound but also highly subjective. It is often related to demographic characteristics of individuals such as age, gender, occupation, access to a car. Understanding the first and second order impacts of this physical alteration of the hub's landscape is only partially included within current appraisals
Journey to Work	Origin-Destination Workflows Mode Shift	This indicator is related to the goals of sustainable mobility, to reduce the distance of journeys and need to travel and making sustainable modes more attractive. Both the MUTP and associated transport initiatives could alter the pattern of travel at the hub
Community Cohesion	Housing Tenure Crime Statistics Quality of Life questionnaires Population Turnover	Demographic diversity, neighbourhood division, community segregation and workplace flows are looked at again with the perspective of considering the impact the MUTP has on community cohesion. Further datasets are housing tenure diversity, levels of crime, quality of life and levels of population turnover
Social Exclusion	Percentage claiming JSA Jobs accessible in <20 mins	From the multitude of factors than contribute to social exclusion, exclusion as result of joblessness has be chosen for exploration. Along with economic deprivation and various accessibility measures, the numbers of those claiming Jobseekers Allowance are included

Fig. 3.5: Summary of the final choice of indicator-set inputs

Accessibility is assessed in the vast majority of transport projects, from the small local scale to mega infrastructure level, such is its position as a key element of transport improvement works. It is within the NATA process in England and features in many of the examples above of international MUTPs. The literary review elucidates the extent to which improved accessibility is seen as an important change following a transport intervention, but it also implies that such change can sometimes be exclusive if planners do not ensure affordability and availability is possible for all potential users. As discussed in the literary review, closely related to accessibility to various extents, are the severance effects of the physical infrastructure, sustainable mobility patterns including the journey to work (where and by what

means), socio-economic deprivation and social exclusion. A further significant group of inputs are urban regeneration impacting upon population turnover, demographic diversity, crime, and cohesion, which can also link in with deprivation. The literary review provides evidence of the initiatives the government has instigated over the last few decades, particularly regarding the impact of transport upon these issues. If the MUTP is capable of providing the catalyst for financial investment at the hub and an opportunity to maximise social benefits for the community (such as the issues described here), the planning, appraisal and evaluation of the project could be orientated so as to facilitate this.

Two key elements provided practical restrictions on the final set inputs: the planners' remit and the availability of data. The remit of local and regional planners covers the variables that are included within the indicator set, such as reducing deprivation, mitigating against severance issues, stabilising population turnover and initiatives to relieve social exclusion. This therefore excluded other possible datasets such as income levels and land value uplift. The second restriction was the availability of data to enable repeatability in another geographical context. All the sources for the indicator set are released for the whole of England (and sometimes Wales) thereby making the methodology easily adaptable to another MUTP hub, such as Kings Cross or along the HS2 route. This aspect therefore restricted the choice of impact indicators further, and as such, quality of life and perception of the effect the MUTP is/was having upon the community members for example are not collected. The repercussions of using only secondary sources of data are discussed within the conclusion (chapter 9).

This marks the close of the contextual background for the potential non-user social impacts within the GIS-based indicator set and the government environment that the output from such a set could be used. Within this chapter the planning system, appraisal framework and evaluation process for transport projects in England was described and critiqued. UK and international transport project evaluations were briefly introduced so as to illustrate the variety of possible objects such impact assessments have, and to emphasise the localised nature of the findings.

The following chapter considers why information technology, including GIS, has such a low uptake in planning and decision-making, and what could be done to improve the situation so that GIS-based tools such as this could be more widely implemented.

4. Information Technology in urban & transport planning

Creating a GIS-based indicator set to assess the potential impacts of an MUTP at a hub presumes that the use and acceptance of mapping software is widespread within the planning and decision-making environment. However this is not presently the case, and the discussion below outlines how computing is used in planning and what are the shortcomings that restrict its full integration into the planning process.

Tasks in planning

Urban planning has several core tasks namely; problem definition, (tasks as inventories of condition and analysis of trends), change, exploration and analysis (alternative scenarios, impact assessment, evaluation of alternatives, development of plans), consultations (discussion, negotiation of goals, alternatives, implementation modes), decisions (decision-making on goals, alternatives, implementation and modes) implementation (dissemination and starting actions) monitoring and evaluation of effects (Batty 1995, Vonk et al. 2007). At a more conceptual level, planning can be considered as having two main strands, the plan-making tradition and the administrative tradition. The 'plan-making tradition' has three main components; socio-economic analysis, technical design and policy decision-making, and these are reflected in the mixed discipline composition of the teams involved. This tradition produces three core elements; policy reports, structure/masterplans (i.e. regional-scale plans that cover 10-20 years) and zoning plans (more local-level plans used as a basis for development and building control. These are often thematic studies such as transport or environmental impact assessments (Masser and Ottens 1999:27-30). The administrative tradition has evolved from the Town and Country Planning Act of 1947, which gave significant powers to local authorities to control spatial development and links to technical and administrative management. It is more continuous in nature than the single project orientated plan-making tradition (ibid.:29). Planning calls on so many different skills that it is possible that any skill could be suggested to be the core of planning, so there needs to be some consideration as to how these can all work efficiently together (Harris 1999:322).

Information Technology in planning

Planning Support Systems (PSS):

Most PSS have been developed since 2000, although in concept it was discussed by Harris in the late 1980s (Harris 1989:87). Yet actual use, adoption, implementation and development of PSS in practice is generally unknown (Geertman and Stillwell 2004:292). Planning tasks that a PSS can carry out are to explore, represent, analyse, visualise, predict,

prescribe, design, implement, monitor and discuss (Batty 1995 cited in Brail and Klosteman 2001, Vonk et al. 2007). Specialised PSS software have also been developed for project management, budget planning, operations, supply-chain optimisation, resource allocation and scheduling (Power 2005:16-18). A PSS would be expected to handle multi-scale spatial, non-spatial and aspatial data, historical data, projections, qualitative and quantitative data. It should also handle implicit, semi- or ill-structured knowledge as well as explicit and well-structured and the modelling, design and analysis of dynamic spatial data or information. Each planning situation will have its own procedure, underpinning theory data, information, knowledge, tools, methods, presentation requirements, and hence likely require a customised PSS, and proprietary GIS can form part of this (Geertman and Stillwell 2003b:7). The strengths of the PSS lies with the ability to bring together the functionality of GIS, models and visualisation to gather, structure, analyse and communicate information in planning, and they are solely dedicated to planning processes. When it seemed that GIS would not meet planners' needs, there were calls for GIS functionality to be extended in the form of PSS to support forecasting and scenario testing (Drummond and French 2008:170). Weaknesses include the perception that PSS outputs seem to embody less knowledge than is available for informing decision-making (Harris 1999:322). User interviews support this suggesting that the nature of decision-making is too complex for computing-based instruments. Instead, the most used functions are information storage and retrieval with some analysis and visualisation (Vonk et al. 2007:1705).

Decision Support Systems (DSS):

There is some overlap with PSS, where these systems both have databases, modelling capabilities and are task-based systems. However DSS can be regarded as specifically to support a decision research process for complex spatial problems, providing a framework for integrating database management systems with analytical models, graphical displays and tabular reporting (Klosterman 2001, Geertman and Stillwell 2004, Vonk et al. 2007). These are usually designed to support short-term policy-making by isolated individuals or business organisations, i.e.: executive decision-making rather than professional planning (Ayeni 1997, Uran and Janssen 2003). The systems ought to be approachable and straightforward for a range of users, and are able to model planning concerns such as traffic, pollution, and energy and water consumption (Turban and Aronson 1998, Laurini 2001, Quaddus and Siddique 2004). 'Spatial' decision-support systems have a further geographic data manipulation element, and are of significant benefit to the DSS (Densham 1991), along with the potential to incorporate multi-criteria evaluation using quantitative and/or qualitative data (for example the selection of a water supply pipeline route) (Jankowski and Richard 1994, Carver 1999). Uran and Janssen (2003) cite several reasons why DSS are not widely used, such as the system is too detailed, time consuming and costly to use, uncertainty of the models output and the appropriateness for solving the decision-makers question. Also limited involvement of the users in the development phase meant an unsuccessful product,

and the lack of training in specific systems or software (Uran and Janssen 2003:512). Furthermore, in a survey of five popular SDSS used in Dutch coastal management, none supported the ranking of alternative scenarios, a function that the authors consider to be highly valuable in decision-making (Uran and Janssen 2003:525). Without application to a GIS framework, many multi-criteria analysis tools lack sufficient flexibility to handle spatial data effectively. Combined they make effective SDSS tools (Carver 1999:49).

GIS and GIS-T:

GIS coincided with the revolution in environmental issues in 1970s, including land-use suitability analyses (Drummond and French 2008:163), but has no specific remit for urban planning, providing much broader, generic solutions than PSS or DSS (Geertman and Stillwell 2003b:6). GIS in the plan-making tradition is generally static and aimed at life-limited projects. The system requirements are generally for a single user with a single purpose, determined by a specific application and tools with visualisation and display capabilities. For the administrative tradition in planning, GIS tend to be multi-purpose, multi-user systems, with management information at all levels, and quality assurance for database management and metadata (Masser and Ottens 1999:32). GIS-T is a specific branch of GIS applied specifically to transport issues, used in many varied transport fields from congestion control, carpooling coordination, bus network optimisation and the management of rail freight (Lang 1999). GIS-T has to be good at handling complex data structures, and is required to support transport planning and operations. Examples of specialist transport-related extensions to GIS include shortest path, routing algorithms, spatial interaction models (e.g. gravity models), network flow problems (user optimal equilibrium, system optimal equilibrium), facility location problems (p-median problem, set covering problem such as bus stop location choices) travel demand models (4step generation, trip distribution, modal split and traffic assignment models), and land-use transportation interaction models (Dueker and Ton 2000:257, Rodrigue et al. 2006:36).

The greatest strength of a GIS is in creating new information and combining diverse sources of geo-data through processes of overlay (Harris and Batty 2001:28, Batty 2007:13). A GIS-T is a tool to inform and persuade decision-makers or stakeholders who might otherwise not have time or capability for non-symbolic data representation (Rodrigue et al. 2006:32-33). A study by Crossland et al. (1995) indicated that there was a significant difference in the task solution speeds and accuracy in those that used a GIS as part of spatial decision support in a decision-making process than those that did not. However, GIS are less suited to generating predictive information or forecasting scenarios. They lack elaborate spatial modelling functionality that dominate strategic planning or forecasting purposes needed in urban and regional planning (Ayeni 1997:7-8, Masser and Ottens 1999:34). Some argue GIS could distract planners from developing more important and useful methods (Harris & Batty 1993 cited in (Drummond and French 2008:162)). GIS are not inherently suited to planning

processes although as a tool they have potential in areas such as analytical, predictive and prescriptive, and could be optimised for simulation, and design activities used in spatial planning (Harris and Batty 2001:25). Planners would need an appropriate framework in which GIS can be used sensitively and accurately in a wider system of methods, which have often found to be absent for reasons discussed in detail below. GIS can deal with physical map representations, but are not appropriate for sophisticated large-scale simulations or effects of interactions which require high-end computing, hence GIS are limited by their intrinsic nature to fail if used as main tool of analysis of planning (Harris and Batty 2001:26-7). GIS are furthermore less suited to generating predictive information or forecasting scenarios as they lack elaborate spatial modelling functionality (Masser and Ottens 1999:34). Good urban models cannot be easily built using GIS tools, and not likely to be resolved due to the theory-laden content of urban models that conflict with modular generic software (Batty 2007:8). GIS lack prediction and design tasks that dominate strategic planning or forecasting purposes needed in urban and regional planning (Ayeni 1997:7-8). Finally, GIS do not perform static or dynamic modelling as well as specialised modules (Bishop 1998:190). For these reasons GIS is ultimately not suitable to use alone in planning processes (Harris and Batty 2001:27).

Potential users of IT in planning

Vonk et al. (2007:1702) identified five potential planning actors as main users of PSS, for example:

- professional planners (including designers, planning policy workers, planning consultants),
- executives (including managers and politicians),
- geo-information specialists (including working planning organisations, consultancies and universities),
- citizens (increasingly involved in collaborative and participatory planning processes),
- professional stakeholders (representatives of groups of people or organisations)

This short list does underline the variety of tasks and requirements that IT systems are required to perform at different stages of decision-making. This large scope does however prove to cause friction regarding the acceptance and use of IT, as discussed below.

How IT-based support systems could be better utilised in a planning context

Public participation GIS (PPGIS) & Internet-based systems:

In an assessment of public on-line participation of PPS, Al-Kodmany et al. (2003:65) remark that digital map design and tools allow users to navigate and give feedback in the community planning process. In the past planners would traditionally lay a large map out on the table at participation workshops and have each participant mark ideas upon it. Now updating and editing information on digital maps is quick and cheap and potentially accessible to many more people (Al-Kodmany 2003:66). PPGIS and internet-based GIS could facilitate increased levels of interaction by citizens; two-way communication between public and planners, and any alternative plans produced are published on the Internet. Future

developments could continue to expand using 'mash-up' application programming interface (API) functionalities and citizens are able to provide additional textual information. 3D PPGIS could help stakeholders and developers communicate what was being proposed, and could explore impact models and assessments (Drummond and French 2008:172).

Planners do not expect to have all the knowledge and ability to perform planning tasks in solitary, and could interact more with people for whom the plan is being made (Ayeni 1997:3). The 'Delphi' method, where individuals weight criteria that have been put forward for consultation (such as to identify a motorway route), involves reiterating the process until a consensus has been reached (Jankowski and Richard 1994:325). The ability to share data fast over the web is leading to these new kinds of exploratory analysis, where stakeholders solve problems together, i.e.: the 'wisdom of crowds'; sharing and adding value to data (Carver 1999:45, Batty 2007:20-21). Participatory approaches often have the effect of reducing value conflicts and 'untrained' citizens can contribute to knowledge and invention needed for planning, being able to view and comment upon prospective alterations (Bishop 1998:200, Harris 1999:99, Steinberg and Steinberg 2006:95). Web technology can address this as a tool where both the receiver and provider represent an information exchange in a two-way communication, although there are also questions of the demographic of those with internet access, and the need to create a 'critical mass' in order to be effective (Al-Kodmany 2003:67). A recent survey by Slotterback (2010), noted however that the largest demand (by planners, stakeholders and community members) regarding public participatory technology in planning was for the dissemination of information (i.e. via websites) to enhance more traditional participatory collaborations. More sophisticated technology gave rise to concerns about the equity of access and was not considered helpful in achieving planning aims.

In a trial of a prototype web-based geo-collaborative tool, Sidlar and Rinner (2009) considered how to measure the utility of 'argumentation mapping'; a discussion which is geographically referenced. These can supplement the planning process by providing a means to systematically procure and assess both quantitative and qualitative data in a discussion forum with geographically tagged documents within maps. This experiment started well but the authors saw a sharp decline in use and enthusiasm which is not uncommon with web-based collaborative tools (Sidlar and Rinner 2009:3-6).

Visualisation:

Visualisation is becoming increasingly important, especially as the complexity of models and data production increases, and larger numbers of stakeholders are involved in the planning process (Batty 2007:23). 3D visualisation tools are useful although have not been well supported in the past. The perception was that it was possibly easier to devise plans with a pencil and paper, as one cannot sketch easily or doodle in a standard GIS (Vonk and Ligtenberg 2010:167). ArcSketch and tablet PCs are opening up new areas though for a

more sketch-friendly approach to planning (Drummond and French 2008:172). The recent 'socio-technical' design (see Vonk and Ligtenberg 2010:169-70 for details) of a PSS with integrated GIS elements and an innovative hardware solution called 'Mactable' have so far proved to be relatively successful with planners in responding to tasks that require free-hand drawing. Evaluating the output of a selection for horticultural relocation, despite some software issues, the planning test-users found that there was increased functionality and usability over past traditional sketching-enhanced PSS. Their study also accentuates the large benefits associated with engaging with users in the software development stages, as discussed below (Vonk and Ligtenberg 2010).

Why IT-based systems are not fully integrated in planning practice

So why are computing solutions still not fully embraced in planning, and why are there more failures of system implementation than successes (Geertman and Stillwell 2009)? Planning IT systems failed in the 1960s and 70's due to their overly complicated nature and 'data hungriness' (Geertman and Stillwell 2003b:4). However, failure of the adoption of technology in an institution can be the result of social attitudes of that organisation rather than technical issues alone (Masser and Ottens 1999:38).

Several issues were noted repeatedly in several literary sources;

- There appears to be a large dichotomy between the needs and skills of planners and what is supplied by the developers of the technology
- The 'black box' nature of some systems have meant that planners and decision-makers have sometimes failed to grasp the subtle nuances of social processes which result in less than optimal intervention, leaving them reluctant to continue engaging with the technology
- Given the diversity of analytical tasks which planners perform, there is a relatively small niche for public sector software given the expense of developing and supporting commercial software. Hence analytical tools for planning lag far behind professions such as transportation, engineering and other government areas
- High level of data/information production is required but there is a mismatch between data needed and data being collected
- General PSS cannot really handle vague, synergic qualitative elements of the planning process, so current proprietary systems can be considered too generic, too complex, too inflexible, and incompatible with most planning tasks. They are orientated more towards technology rather than problems, and focused on strict rationality/technocracy
- Many are one-off systems operated by a team or an individual university researcher(s) who developed it
- Limited use by decision-makers is a problem as most PSS are seen to interfere with the nature of politics as a 'game of power'
- There is too little use of PSS by project stakeholders and citizens, which inhibit facilitation in their participation.

(Harris and Batty 2001, Klosterman 2001, Geertman and Stillwell 2003a, Preston and Raje 2007, Vonk et al. 2007, Brail 2008, Preston 2009, Lucas and Currie 2011)

In the past a self-taught computer-literate planner could procure census data, perform some calculations and impress their work colleagues by producing thematic maps. Although the learning curve was initially steep, it flattened rapidly and overheads were low. More recent systems require a high level of technical support and staff training to be effective for anything

more than a straightforward thematic mapping exercises (Drummond and French 2008:171). However Lucas et al. (2007:37) suggest that policy and political need for the social impacts of transport are exceeding current technological capabilities. This suggests that there could be problems in transforming the conceptual level of understanding of social impacts into effective computing tools, and furthermore, a bottleneck in having staff trained and confident to exploit them fully.

In a recent review of the restrictions on use of decision and information support tools relating to desertification issues, Diez and McIntosh (2010) conducted interviews with 31 planning organisations across the world. They summarised the findings of those interviews in a table (fig. 4.1 below) to understand the drivers, constraints and impacts of the use of such support tools, which included GIS.

Driver/constraint/impact	Description	
Driver	Mandate of organisation Potential uses of information	Impact assessment Impact monitoring Facilitation of communication Facilitation of participation Forecasting Helping decision making Improving process understanding
	Provision of more detailed information System attributes	Data collection Data management Ease of use Flexibility Information integration Information updating Low cost
Constraints	Financial investment	Computer acquisition Employment (additional) Training provision
	Information attributes Mistrust of developer Need for support to use DIST Need for updating of information in DIST Need for validation of DIST Scarcity of documentation Tool complexity New work protocols	Uncertainty Irrelevance Incompleteness Unreliability
Impacts	Changes to execution and performance of work	Better effectiveness Better efficiency Capability to perform new activities Facilitation of information dissemination Freeing up time for other work Improved participation & decentralisation of decision making Improved communication internally and externally
	Changes to organisational structure Financial investment	Allocation of new responsibilities Establishment of new units or departments Independence from other organisations New mandate of organisation New work protocols Computer acquisition Employment (additional) Training provision

Fig. 4.1 Drivers, constraints and impacts of the use of decision and information support tools (Diez and McIntosh 2010).

Many issues highlighted in this table confirm the preceding literature and serves to emphasise that very little has changed in the last ten years despite the increasing proliferation of IT in daily life. So how could IT tools be better integrated into the planning environment?

General future recommendations

Many of the IT user reviews recommended similar aims:

- Systems need to be more user-friendly: a very common suggestion in planning IT reviews, and that this approachability was at all levels of planning, not just at the geo-information experts' level. The need for user-friendliness was particularly cited in modelling and future impact analyses
- Systems need to be better thought-through and well developed programmes with user input, i.e.: engaging with 'communities of practice'
- Poor quality user interfaces reduced the ability for planners to carry out the task fully, in contrast to well-designed interfaces, which required less training and improved work production.
- Systems need to be more flexible and adaptive as planning processes evolve with emerging issues
- Systems are still in relatively early stages of development and currently lack standardisation while large differences in quality exist
- Better training for all potential users is required so that they feel confident in their output
- Many organisations are experimenting with intensified consultation in planning processes, so systems should be more tailored towards collaborative and/or web-based solutions, so as to allow content from a wide variety of sources to be included into the decision-making system, such as photos and text from citizens (although see Slotterback 2010 for reservations)
- Increased 3D capabilities are needed
- Systems need to have better cross-platform integration and functionality
- That low-tech solutions existed for responding to some planning needs
- There was greater collaboration with academia; interdisciplinary approaches could yield for novel ideas and approaches.

(Ayeeni 1997, Klosterman 2001, Dix et al. 2004, Geertman and Stillwell 2004, Campagna et al. 2006, Drummond and French 2008, Geertman and Stillwell 2009).

Computing in planning and the research scope

What do the above constraints mean in relation to the adoption of the indicator set as a GIS-based tool within the planning, appraisal and evaluation process for an MUTP? Given that this GIS-based indicator set will not have scenario-building capabilities, nor will it offer a range of optimal solutions, it could be considered as an information support tool. It is possible that an approach such as this could be coded as a proprietary software programme with a user-friendly interface, making use of the ArcObjects functionality that the back-end of the GIS uses. In this hypothetical context, what barriers may exist that reduce the acceptance of this 'indicator toolkit' software for social impact appraisal and evaluation? Drawing from the sections above regarding why IT tools are not more fully integrated, this GIS-based indicator set remains vulnerable to many elements described, but strives to avoid many others in order to increase its potential acceptability.

With respect to potential pitfalls, there is undoubtedly an absence of GIS-trained staff in most planning departments, and the review above revealed trends regarding the level of technical aptitude and prevalence of IT in the planning the decision-making environment. This was confirmed in Gravesham Borough Council (the local planning unit for the main case-study

area; Ebbsfleet) and the South East England Development Agency (the funding body for this research), where I requested to spend time in 2006-07 in order to observe the use of digital datasets and tools. Neither organisation had such staff or job-roles that required these skills. Assuming that a fully functioning indicator GIS toolkit software was available, there would be a dearth of staff within these planning and decision-making organisations to make the best use of the outputs. This is exacerbated by the high costs of commercial licences for the most popular GIS, although opensource GIS software is available such as Landserf or Quantum. It is arguable that an MUTP comes so rarely within the boundaries of a local planning department, and secondary datasets are published infrequently (e.g. every 10 years for the census), whether it is appropriate to expect the indicator set to be used by planners. A realistic scenario for the real-world adoption of this indicator set approach would most likely be the data collection and preliminary analysis to be performed within a planning consultancy following a detailed discussion of the potential outcomes desired for that infrastructure project. The absorption of a social impact 'toolkit' software programme into a consultancy would relieve the public sector of the cost (in terms of time and money) of purchasing software and training staff members or recruiting planners with a strong GIS background. However it could be argued that GIS-trained staff would enrich the planning process in a number of ways as described above, aside from this niche aspect of monitoring social impacts for one large project.

Having collated a range of suitable digital datasets to explore the issues discussed in chapter 2 above, the local planning team would engage with the consultancy with regards to further refining the boundaries (both temporally and spatially) based on their detailed local knowledge. The GIS could then produce a social profile at a variety of time periods, depending whether the infrastructure project was at the planning, appraisal (both pre-implementation) or evaluation (post-delivery) stage. If a single pre-implementation planning stage profile was created, this could also perform as a Social Development Needs Analysis as described by Esteves and Vanclay (2009). This would reorientate the emphasis of the impact assessment away from merely a regulatory hurdle to mitigate negative impacts, presenting instead a valuable opportunity to maximise the social equity in the project for all community members.

Another potential pitfall is that as an informational support tool, there are no modelling abilities within this indicator set. As discussed within chapter 3 regarding planning, appraisal and evaluation procedures, quantification, monetising and summary tables are very much in current government favour. Hence there is an inherent conflict regarding expectations and a desire by decision-makers to ascribe a hard figure to the impact outcome, which does not sit well with the complex and dynamic nature of the social impacts described by the indicator set. However, assuming that decision-makers are open to a new approach, this indicator set

would very much compliment existing processes by providing a new and under-reviewed aspect of the infrastructure project, alongside the conventional measures.

In keeping with the research scope and the advent of the Localism Act 2011, communicability of the outcomes of the impact assessment is instrumental in engaging with a variety of decision-makers and stakeholders. This includes the affected community members at the MUTP hubs, and hence the ability to disseminate the impact information quickly and widely over a diverse assortment of media could be powerful. This may include the use of public participation tools or web-based APIs that allow GIS data to be displayed, with a basic level of manipulation over the internet as described above. Restrictions such as data licensing and copyright issues would have to be considered before this could be implemented, but an increasingly large amount of government-collated data are being released to the public realm (The Guardian 2011). It is hoped that the issues covered within the indicator set are considered to be impacts that can be understood by most people without specialist training. Critiques of the indicators including comprehension and interpretability are included within the findings (chapters 7 and 8) below.

The aforementioned absence of dedicated personnel to undertake any form of spatial computing planning or analysis at S.E.E.D.A nor Gravesham Borough Council, set the stage for formulating a very transparent, very flexible and intuitive social impact GIS-based indicator set. The tendency for decision-makers to feel mistrustful of the output from a 'black box' system with highly sophisticated modelling parameters was noted in the literature. Therefore creating fundamentally basic mapping outputs that serve to give planners and decision-makers a starting point for understanding where - rather than how - (negative or positive) social impacts were occurring, could provide a guide to managing the impacts within the MUTP appraisal to implementation and delivery stages.



Fig. 4.2: Norbert Weiner's communication model (derived from Steinitz 2007)

The above fig. 4.2 implies a strong need for a two-way dialogue between the three elements as the designer must be able to respond to what the 'viewer' (everyone including planners, decision-makers, stakeholders and community members) would like to know, in this case the potential non-user social impacts of the MUTP.

A system designer (such as myself) and the end-viewer (users such as planners and decision-makers) need to share:

- Knowledge of conventions
- Common language
- Knowledge of audience

- Knowledge of subject
- Context, which can limit the aspect. (Steinitz 2007)

Some of these suggestions seem to be missing from the current system development and delivery process. In the absence of GIS personnel at the aforementioned organisations, the social impact indicator set was designed to answer some general areas of concern that arise from MUDP planning noted from government policy and a variety of research outcomes, in terms (meanings and impressions) that were clear and user-friendly.

This chapter sought to provide an overview of the use of IT in planning. The first section began by describing generic planning tasks. This prepares the reader for what urban and transport planning IT tools exist to support planners such as Planning Support Systems, Decision Support Systems and GIS. Their various strengths and weaknesses were discussed before the latter half of the chapter defined the complicated and varied reasons behind the reluctance of the planning field to utilise IT tools more. These barriers to better integration of IT tools in the planning sphere need to be considered in the context of hypothetically creating the indicator set as a real-world software programme. Potential drivers and constraints of use by planners were considered, with some recommendations relating to who the key users could be, and how cost and training concerns could be effectively managed.

The following chapter introduces the case-study MUDP, the Channel Tunnel Rail Link (CTRL) and the two hubs, Ebbsfleet and Ashford along with a discussion of the spatial boundaries, digital datasets and recent CTRL impact studies.

5.

Case-study:

Subject and sample

This chapter introduces the main Mega Urban Transport Project under study; the Channel Tunnel Rail Link (CTRL) and the two ‘hubs’ in Kent; Ebbsfleet and Ashford. These were selected because of the interests of the research funders (the South-East England Development Agency) and the remit of the Omega Centre Project 2 framework (Omega website 2011). The second sub-section provides an overview of four evaluations of the CTRL and its impacts, and the chapter closes with a summary of the case-study sample, namely the spatial and temporal boundaries and associated issues.

The case-study MUDP: Channel Tunnel Rail Link (CTRL)

Following the opening of the Eurotunnel in May 1994, the Eurostar International passenger service commenced operations in November 1994, running trains on the existing rail infrastructure from Waterloo (south London) non-stop through Kent and onwards to the continent. Early in 1996, train services started collecting and depositing passengers at Ashford International, which remained the only non-terminus station in England until over ten years later.

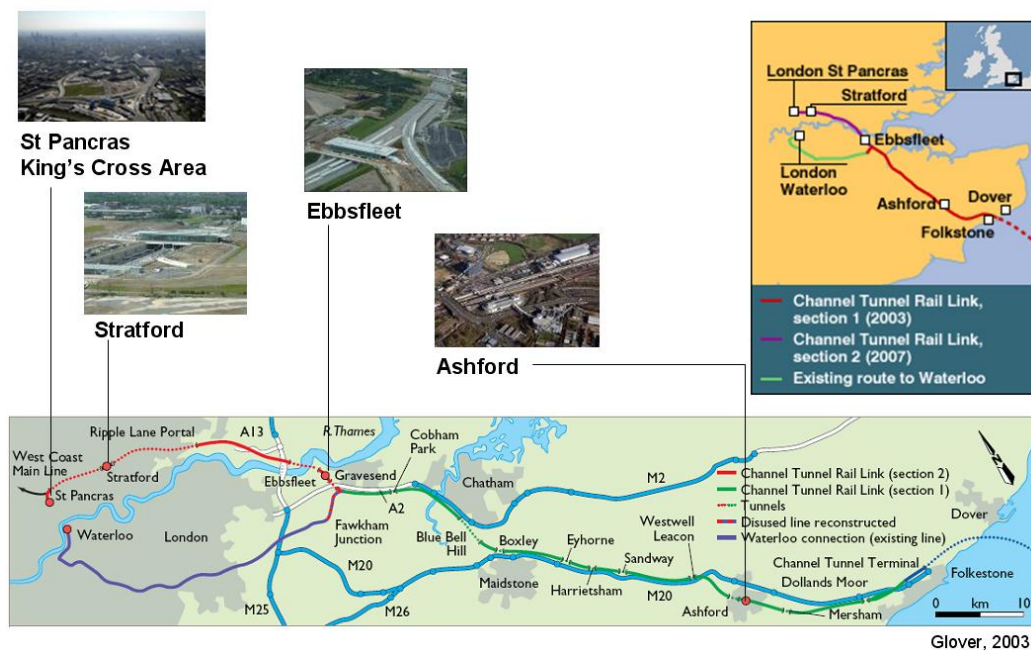


Fig. 5.1: CTRL phase 1 and 2: Routes through Kent

A dedicated high-speed rail link was proposed by British Rail and private developer, Ove Arup in 1989, and subsequent to the lengthy route evaluations, the hybrid CTRL bill was

given Royal Assent in 1996 and a planning outline was defined including three additional stations; St Pancras, Stratford and Ebbsfleet (fig. 5.1) (Butcher 2010a). The CTRL was constructed in two separate phases for political, financial and engineering reasons. The first section ran from the Channel Tunnel to Fawkham Junction (just south of Ebbsfleet area) in operation between 1998-2003. The second section between Fawkham to St Pancras, was constructed between 2001-2007, which added Ebbsfleet, Stratford and St Pancras to the route (Taylor 2011a).

The main government objectives from the outset were to increase the capacity between London and the Channel Tunnel, and to facilitate a high speed link from Kent to London for domestic passengers. The urban regeneration potential was first cited in 1988 for Kings Cross, 1990 by Newham Council for Stratford, and 1991 to tie in with the Thames Gateway redevelopment championed by Michael Heseltine (Omega Centre 2011:70-71).

In a review of why the CTRL could be construed a planning 'disaster', Myddelton (2007:148) considers several aspects of the project's implementation that did not transpire as anticipated. Key aspects include the vast over-estimation of early passenger numbers, which were c70% higher in 1987 forecasts than actual numbers in 2003. This was a result of price wars with cross-channel ferries and the unanticipated success of low-cost airline services (ibid.). The other major element of poor project delivery was related to the complex financial structuring and overspend which confirmed initial expectations that there had been no business case for the CTRL (National Audit Office 2001:36), but that it was seen by the government as a national prestige project (Myddelton 2007:150). Poor onward travel connectivity from London Waterloo and Paris Gare du Nord may also have been a factor, which relocating to St Pancras could ameliorate (Preston and Wall 2008:405). However, optimism bias is a well known issue with major infrastructure projects (Flyvbjerg et al. 2003). Butcher (2011) provides a detailed discussion regarding the financing structure of the CTRL, and for a more detailed analysis of the events and decisions associated with CTRL, see Gourvish (2004) and (2006), and the Omega Centre (2011).

The main case-study hub: Ebbsfleet and Kent Thameside

Ebbsfleet International station is located in a brownfield area of former clay- and chalk-pit quarries between Dartford (to the west) and Gravesend (to the east) near the Thames riverfront (fig. 5.2). It is in the heart of the Kent Thameside regeneration area, which aims to deliver 30,000 new homes and 50,000 new jobs in an area of around 22 sq miles (fig. 5.3) (D.C.L.G. 2006:72-74). This is the main case study to reflect the large-scale impacts that the CTRL may have on the local area.

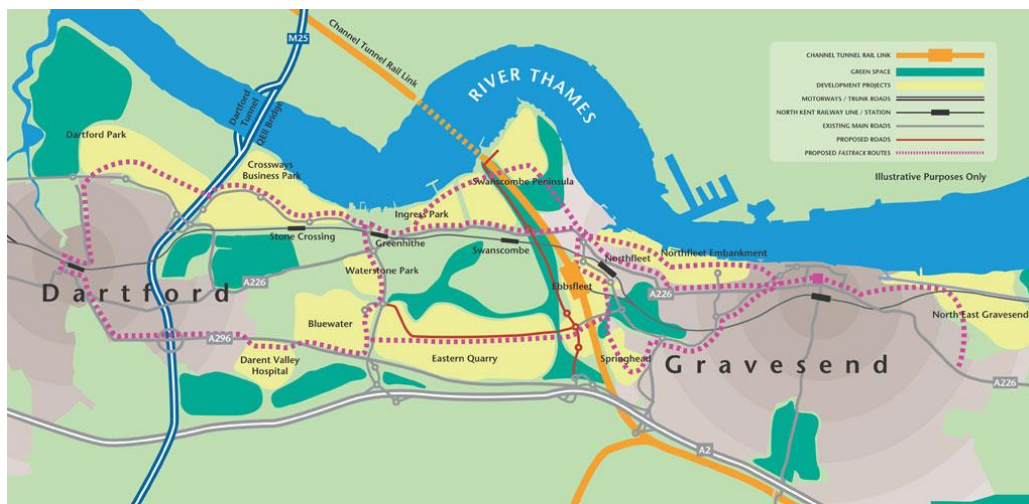


Fig. 5.2: Kent Thameside development opportunity area (Gravesham Borough Council 2007)

Work on the new 'Ebbsfleet Valley' development scheme began in January 2007 by Countryside Properties in the Springhead Park section. The first group of new dwellings were 388 contemporary one and two bedroom flats and two, three and four bed houses (Countryside Properties 2006).



The scale of development planned at Ebbsfleet Valley

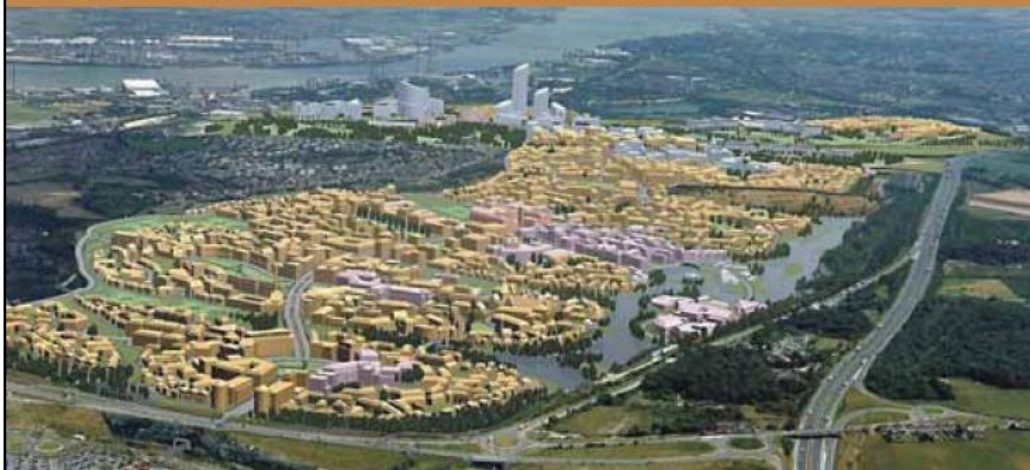


Fig. 5.3: Now and the planned future for Ebbsfleet Valley. Thames Gateway Interim Plan (D.C.L.G. 2006:75)

Although the properties initially sold well in 2008 (Land Securities 2008), further building on site has ceased since late 2008-09 following the housing market crisis (Building.co.uk 2009).

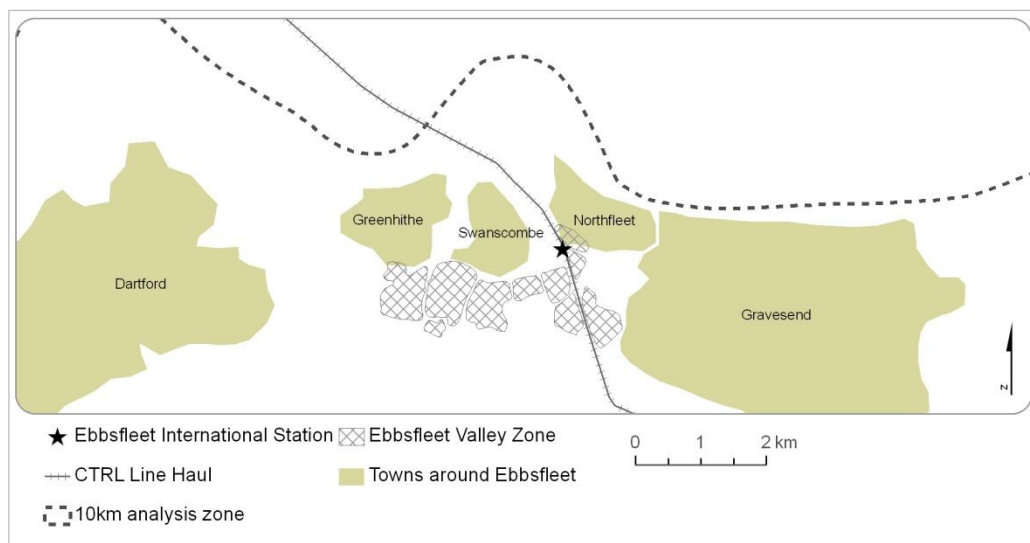


Fig 5.4: The urban communities around Ebbsfleet International Station (depicted from Google Maps 2010) [©Crown copyright/database right 2011 An Ordnance Survey/EDINA service]

There are three smaller communities around the north of the proposed development around Ebbsfleet Station; Greenhithe, Swanscombe and Northfleet (figs. 5.4 & 5.5).

Town	Popn (mid-2009 est)
Dartford urban area	83580
Greenhithe ward	5740
Swanscombe ward	7280
Northfleet ward	7590
Gravesend urban area	77080

Source: Kent County Council ward-level mid-year estimates

Fig 5.5: Mid-2009 population estimates for communities around Ebbsfleet station

Greater clarity regarding the level of deprivation and demographic profile is provided within the impact indicators (chapters 7.1 and 7.2).

Journey times to Ebbsfleet from St Pancras are 17 minutes via the CTRL (vs. c70 minutes by car). It is hoped that not only will the fast journey times be attractive to workers who could commute into London, but that reverse commuting into the area will occur (O.D.P.M. 2003). The new International Station at Ebbsfleet opened on 19th of November 2007, with 9,000 parking spaces (compared to the 2,000 provided at Ashford International). It is strategically located close to the M25 (London Orbital Motorway) and is expected to act as a Park-and-Ride station for much of south London, which is now deprived of the International terminal at Waterloo (H.S.T. Impact Consortium 2008).

The comparison case-study hub: Ashford

The Ashford hub is the 'comparison' case-study, a large town in mid-Kent that has had the Eurostar service serve its station for 11 years longer. Journey times have reduced from 70 to 37 minutes to St Pancras since the CTRL was completed, and this scheme has not been part of a MUDP-related regeneration programme. However since 2001, it has been designated - along with Milton Keynes, the Stansted/M11 corridor and the Thames Gateway - as a major Growth Opportunity Area (fig. 5.6) (O.D.P.M. 2003).

The mid-2010 urban population estimate is 115,000, up 1.3% on the previous year's estimate (Kent County Council 2011), a population level that has trebled in the last 40 years. Following the £2.5bn investment in new homes, jobs and other facilities and services the town will double in size over the next twenty years (Ashford Borough Council 2011)

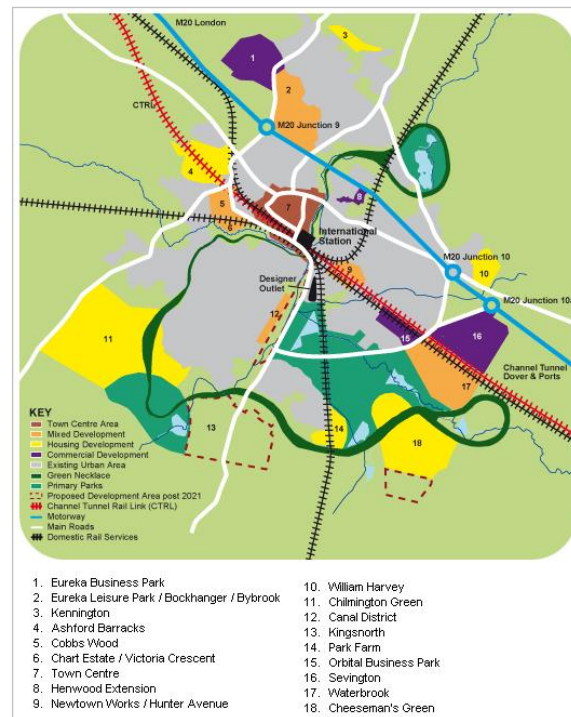


Fig. 5.6: Ashford growth area development: Masterplan 2007

In Ashford's Area Transport Study (2004), the report remarks that if new job opportunities were not created in line with the rise in residential development, the pressure for out-commuting will continue to increase, and the CTRL domestic service would exacerbate this (Ashford Borough Council 2004: 9.8.2). The 2008 Core Strategy for Ashford (2006-2021) considers transport to be a central factor in shaping the town's growth. Encouraging cycling and walking whilst discouraging car journeys and reducing the need to travel are key elements of the strategy (Ashford Borough Council 2008:11.1-11.4). The strategy also proposed to adopt a 'mend before extend' approach to development, whereby attention is paid to ameliorating current social issues such as disadvantage, exclusion, inaccessibility

and lack of community facilities before increasing density (Ashford Borough Council 2008:4.5-4.10).

Impact studies of the CTRL

Below are four different examples of impact assessment research conducted on the Channel Tunnel Rail Link and its hubs.

1. HST Impact 2008:

The Thames Gateway Partnership, Kent County Council and the Cross River partnership were partners in an EU INTERREG IIIB project entitled HSTplatform (2001-2004). The South East England Development Agency (SEEDA) were lead partners in two further INTERREG IIIB projects; HSTintegration (2002-2008) and HSTconnect (2003-2008). All three covered a range of issues related to the impact of the CTRL (and other High-Speed rail projects in NW Europe). They were funded by the European Regional Development Fund (HST Impact Consortium 2008:i). HSTintegration looked at how a range of government agencies generated spatial planning policies and implemented 'best-practice' investment of High-Speed Train (HST) projects, whilst HSTconnect focused more on the interchange between the HS rail network and secondary transport systems, and also considered the social and economic aspects of development of the areas surrounding the station. Both HSTintegration and HSTconnect produced three studies. HST Impact is relevant to this research, exploring additional social and economic benefits that HST investments bring. The two other studies, HSTconnectivity and HST Policy Study, assess the impediments to more cohesive transport systems and the political mechanisms surrounding the delivery of high-speed rail projects respectively. The HST Impact report was produced (final draft) April 2008 by SEEDA and aimed to demonstrate to decision-makers the positive value-added socio-economic and environmental benefits that come with investment in high-speed rail (HST Impact Consortium 2008:i).

This was a qualitative study rather than a full socio-economic impact assessment, on 14 sites in NW Europe, hence impact benefits varied context to context, but generally urban development, transport and mobility, economic development and social development form the four main research areas (HST Impact Consortium 2008:3). Both of the case study hubs are considered in this report. Ebbsfleet has two impact indicators mentioned; the re-development around the station, which is part of the larger Kent Thameside development on brownfield sites, and the new Fastrack bus network, which has been in receipt of €45bn of investment. In Ashford the central indicator is the improvement to the town centre through the paving of the main shopping street 'Bank Street' and better connectivity to the train station for pedestrians. The case studies cited higher relative accessibility as a main impact too, mainly as a reduction of journey times. The authors also remarked at the time of the study, some of the investments were still on-going, hence there was an inherent difficulty in assessing an 'impact' as such (HST Impact Consortium 2008:vii). Furthermore, the

investment that the HST brings to the area becomes integrated into broader investment strategies for the area, and so it has been impossible to discuss solely the direct impacts of the HST investment. The HST can often prove to be a catalyst for continued investment in the area as optimism increases in the region's continued growth (HST Impact Consortium 2008: iii, v & vii).

The report continues to say that there is nonetheless clear evidence of what can be considered HST related investment, often incorporated into wider urban development plans. These encompass improved working, living, and recreational facilities around the station area. Further improvements include altering the space around stations that can be viewed as dangerous and unappealing making them more accessible from city centres, creating a welcoming gateway to the city. Initiatives include adding cycle paths and parks, car-parking and pedestrianisation. Connectivity is further improved by upgrading infrastructure such as road and bus lanes, and new or improved metro stations (HST Impact Consortium 2008: iv). Secondary feeder services have also been introduced in some HST station areas and therefore increase the potential passenger catchment area (HST Impact Consortium 2008:v). Indeed being an HST hub is seen by many cities as highly important in being able to maximise their economic development and raising their economic prominence in the region (HST Impact Consortium 2008:vi). Interestingly the HST impact study found that only in a few cases (Ashford being one) has the property market increased at a greater rate than the general market trend. In most cases, there was very little impact. The retail market shows the most increase, with the CTRL terminus at St Pancras showing significant increases in rental costs and low vacancy rates (at the time of the report's writing). There was similarly a generally positive impact on the prices of office development seen at Ashford (HST Impact Consortium 2008:vi). The report authors remark, although without citing references, that other literature support the evidence that there are sometimes significant time lags between the delivery and operation of the HST and economic impacts at the hub such as real estate markets (HST Impact Consortium 2008:8).

2. The *Ex-ante* and *Ex-post* Economic and Social Impacts of the Introduction and High Speed Trains in South East England: Preston and Wall (2008).

In their literature review, Preston and Wall (2008) propose that it is reasonable to expect there to be some Wider Economic Benefits (WEBs) over those calculated through traditional cost-benefit analyses (CBA) in an area served by the CTRL. This would be through agglomeration economies and the uplift in competitive land values and labour markets (ibid.:403). Factors that they consider to be important to ensure that a high-speed rail link acts as a catalyst for WEBs include the station becoming the centre of the regeneration efforts, becoming a multi-modal local and regional travel interchange and running a frequent service (Bertolini 1999 and ibid.:407). Accessibility changes for Ashford before and after the completion of Phase II to the continent (around 18% to Paris) and the running of the

domestic service to London (almost 75% increase) were notable, as were the accessibility improvements for most Kent towns that linked into the high-speed network (ibid.:411-413). For Ashford, the authors analyse several socio-economic trends and compare them with the SE England Government Office Region (GOR) and England. Dummy variable regression analysis suggests that the population levels rose by around 11% and employment levels rose by around 6% compared to the GOR during the 1990s, although these are not considered to be statistically significant. Property prices have risen just under 3% more than in the SE GOR, and this is statistically significant. Other variables explored include the drop of vacancy rates in commercial properties (a drop of 8% compared to a rise to 9% in the GOR), greater growth of new businesses than elsewhere, yet the growth of floorspace was less than elsewhere and growth in occupied floorspace approximately the same (Preston and Wall 2008:413-415). They conclude that, the extent of impacts was similar to that seen in the in the Sheffield Supertram project, where impacts were concentrated within around 100m distance from the stations (and only 12-15% of impacts could be attributed to the project) (Haywood 1999). CTRL data were too spatially and temporally coarse to make a detailed evaluation. Furthermore even at the district level, the socio-economic impacts in Ashford were considered modest (Preston and Wall 2008:415).

3. Colin Buchanan & Volterra (commissioned by London & Continental Railways): 'The Economic Impact of High Speed 1: Final Report' 2009:

Comparing a 'do minimum' scenario (of no dedicated high speed link and the Waterloo terminus) and 'do something' (construction of the CTRL/HS1 and move to St Pancras terminus), the report estimated that HS1 will deliver nearly £20bn in economic benefits and long term growth against a total cost of £7.3bn. The benefits under study were

- Financial (net rail revenues)
- Transport user benefits (time savings and reduced congestion)
- Wider economic benefits (enabling central London growth, reducing travel costs and improving labour markets)
- Regeneration (supporting government social and economic development policy objectives along the route) (Buchanan and Volterra 2009:5-28)

Taking a closer look at the regeneration benefits, the report comments that the D.F.T.'s consideration (in 2008/9) of regeneration was limited in scope by only considering increased employment amongst currently unemployed residents of the regeneration area. Their study calculates this value, and in addition, considers how the CTRL will have significant impacts in changing development and employment around the stations. They note that there could be a 'trickle-down' effect where some people employed in Kent may choose to work instead in London, and unemployed Kent residents take their vacancies (ibid.:15-19). The report also considered the links between accessibility and employment, population density, economic activity rates, house prices and deprivation measures. They found that there were reliable indicators of regeneration linked to increased rates of commuting into London (ibid.:22-23). Buchanan and Volterra review the appraisal of the CTRL, and consider solely the transport

costs and benefits to have a BCR² of 0.96; hence costs are slightly higher than benefits. Yet when WEBs are incorporated (move to more productive jobs, pure agglomeration, labour force participation and imperfect competition) the BCR is 1.76. This suggests that the regeneration effects raise the scheme's benefit ratio over costs to make it attractive, and value for money (ibid. :24-25).

4. Quantification of the non-transport benefits resulting in rail investment: Banister and Thurstain-Goodwin 2011.

The final sample CTRL evaluation proposes that non-transport impacts be explored at three spatial scales. The incorporation of these impacts are deemed highly important given the high costs of construction, maintenance and operation of rail links when compared to the limited travel time savings made in areas where there is already high network density (Banister and Berechman 2000:212-13). At the local, micro level, impacts upon residential and commercial value may be witnessed which could extend up to 1km away from the station for residential properties, but around 400m (i.e. around a five minute walk) for commercial properties. However, the effect of local contexts means that the impacts can vary greatly especially depending upon the status of the local economy (Banister and Thurstain-Goodwin 2011:216-17). Non transport-related factors that play a role in the extent to which residential property value changes include plot size, living area, age and proximity to other transport links and schools. Hedonic pricing is a useful regression modelling technique to consider these impacts (ibid.:217-18). Regional, meso-level impacts are the effect of agglomeration economies (benefits of proximity to other firms), labour markets (levels of participation in the labour force and work/life balances), network economies (new links between formally separate places may increase competition), environmental externalities (decrease in CO₂ from rail over road vs. noise, NO_x SO₂, CO and HC) (ibid.:214-15). At the macro (inter)national level, economic growth is often cited as a significant benefit of rail investment, although common critiques of this link are the absence of consideration of external factors that could also be causing the growth, and that where a link may be made, causality is not proved (ibid.:213). Research by Banister and Berechman (2000) suggests that the net effect of rail investment is close to zero; it may affect the location of economic activity but not enable growth in the GDP nor employment, and there are more cost effective ways of promoting economic growth than transport investment (Banister and Berechman 2000:318). Here the authors examine the CTRL for these macro-scale impacts and consider that over and above a cautious BCR of 0.5:1 by the D.F.T., the regeneration effects of creating 100,000 new jobs and 50,000 new homes along the line-haul needs to be incorporated. They do remark that the benefits are likely to be concentrated

² Benefit Cost Ratio (BCR) is the ratio of the benefits of a project relative to its costs (both expressed in monetary terms), as a summary of its value for money.

around the station and limited to certain types of activities, and ascertaining suitable measurement units is as yet unresolved (ibid.:214).

Quantitative datasets

In order to explore the potential changes occurring at the two CTRL hubs two spatial boundaries were chosen for each. A 'core' 3km circular buffer around the CTRL international station, within which all the Enumeration Districts (EDs), Output Areas (OAs) and Lower Super Output Areas (LSOAs) whose population-weighted centroid fell within were chosen. A 'wider' 10km circular buffer area was defined to provide a contextual comparison where the impacts are less likely to have occurred (fig. 5.7).

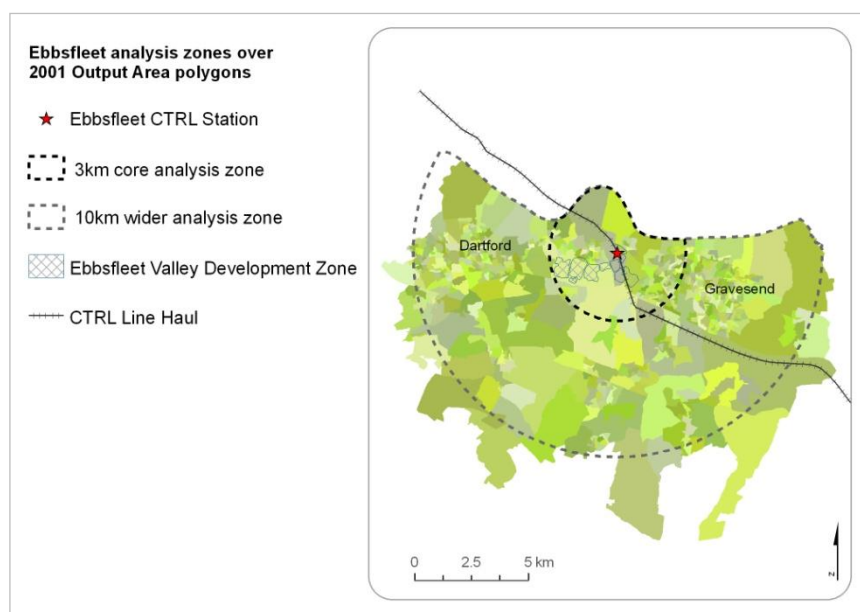


Fig 5.7: Ebbsfleet 3km and 10km zones and 2001 Output Areas [ONS 2001 Census: Digitised Boundary Data (England and Wales) ©Crown copyright]

In Ebbsfleet, the buffers are truncated significantly by the River Thames, as the population and urban dynamics occurring in Thanet, Essex (north of the river) were most likely not linked to the CTRL and would confound any patterning detected. The 10km zone is also slightly truncated to the north-west by the boundary of Greater London, which collected some indicator datasets in a different format making coherence difficult. Within the 3km zone lie the edges of Dartford and Gravesend and the three communities in-between as well as the site for the new Ebbsfleet Valley development. The 10km zone includes the whole of Dartford and Gravesend towns (and the feeder bus service Fastrack for which the accessibility measure is calculated).

In Ashford, the 3km zone encompasses the whole of the urban core of the borough whilst the wider 10km zone has urban/rural fringe as well as the immediate rural communities (fig. 5.8).

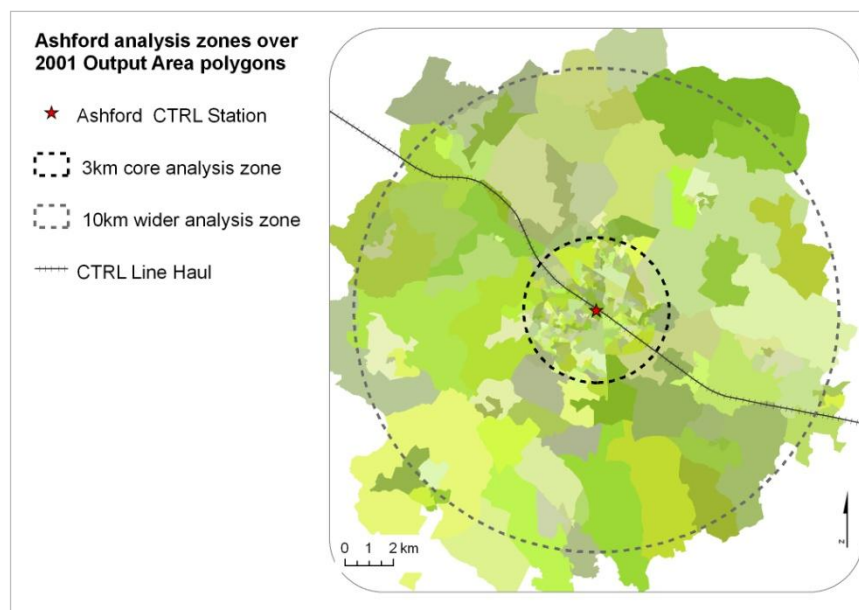


Fig 5.8: Ashford 3km and 10km zones and 2001 Output Areas [ONS 2001 Census: Digitised Boundary Data (England and Wales) ©Crown copyright]

Despite the truncation of the Ebbsfleet Analysis zones, due to the higher population density, there are roughly comparable census area units within the 3km zones but Ebbsfleet has a much higher number within the 10km zone (fig. 5.9):

Census unit	Ebb 3km	Ash 3km	Ebb 10km	Ash 10km
1991 ED	68	98	344	179
2001 OA	121	178	591	275
2001 LSOA	42	36	122	56
2001 Ward	12	17	38	28

Fig 5.9: Comparison of census units per analysis zone per case-study hub

Greater detail is given with each Impact Indicator methodology section, chapter 7, regarding the selection, strengths and weaknesses of the particular datasets used. However two common issues limited the temporal extent of the study.

The first was the changing boundary definitions of the census units, Enumeration Districts, Output Areas (and the wards they were associated with) (fig. 5.10):

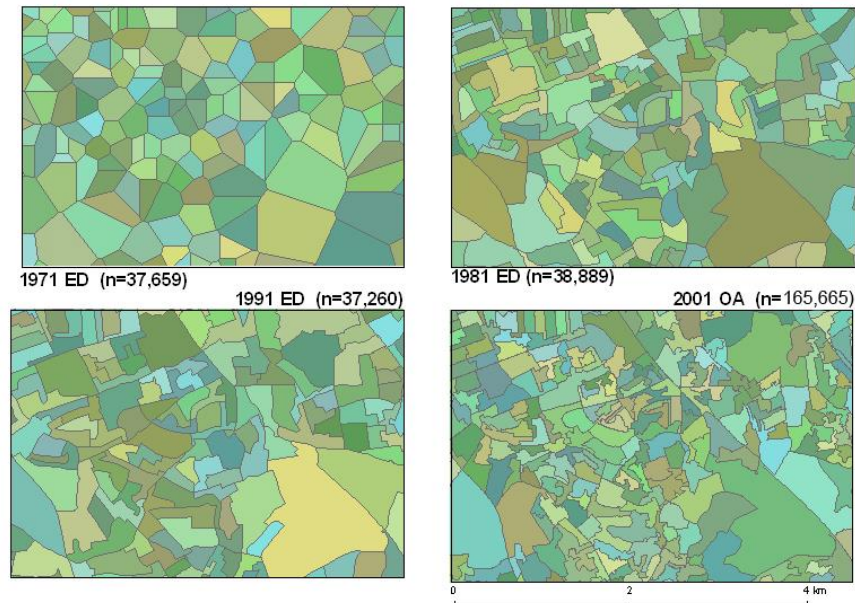


Fig 5.10: Comparison of four boundary units over the same area in south London (n= No. of units in England).
[ONS 1971-2001 Census: Digitised Boundary Data (England and Wales) ©Crown copyright 2011]

As social impacts would be expected to occur at small geographical scales, the differences between the boundaries made a meaningful comparison over time awkward. Therefore, aside from the Travel To Work Indicator, all other Indicators utilise solely the 2001 geographical hierarchy.

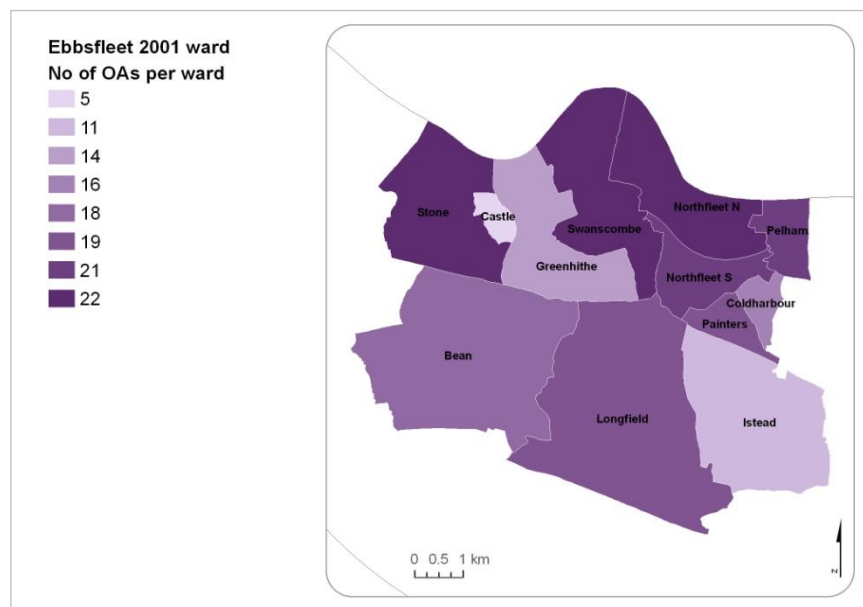


Fig 5.11: Ebbsfleet 3km core wards and the number of Output Areas within (ONS 2001 Census: Digitised Boundary Data (England and Wales) ©Crown copyright 2011)

Only of limited impact to the case-study is the use of ward-level geography that were selected to encompass the OAs and LSOAs whose population-weighted centroids were

within the 3km and 10km boundaries. These are known to be unstable over time and have widely variable numbers of residents within them; from 100 to 30,000 (O.N.S. 2009), which lead to the creation of the Super Output Area hierarchy. For the two case study 'Combined Score indicator set' the 3km core wards are used and in figs. 5.11 & 5.12 demonstrate the differing level of density per ward (number of comparable sized OAs per 2001 Ward):

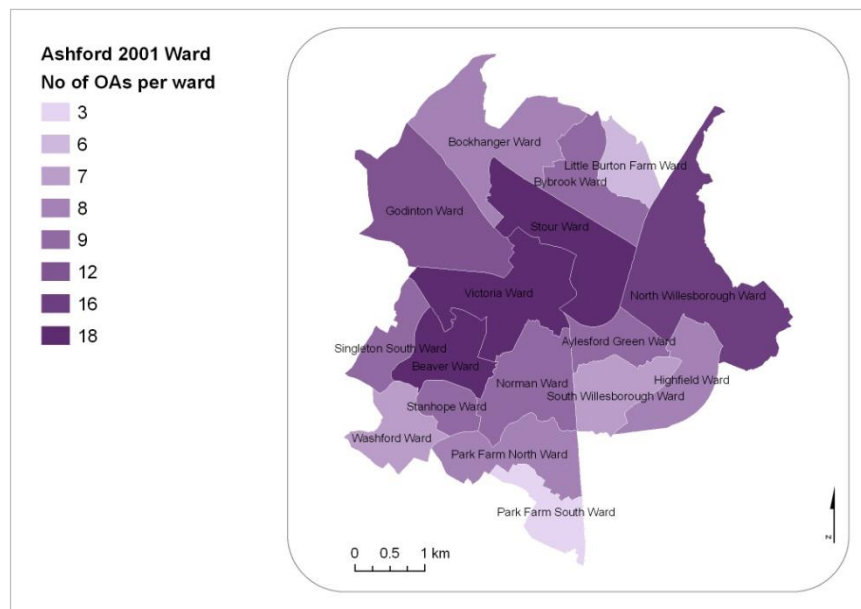


Fig 5.12: Ashford 3km core wards and the number of Output Areas within (ONS 2001 Census: Digitised Boundary Data (England and Wales) ©Crown copyright 2011)

This no doubt has influenced the outcome of the Indicators (discussed in more detail in the findings) and is a strong influential factor for future applications of the indicator set to remain with the SOA hierarchy.

The chapter has provided a synopsis of the pertinent aspects of the MUTP and hubs under study. The initial part of the chapter defines the MUTP under study, the CTRL, and provides a brief overview of the complex planning and financial factors. Subsequently, the two non-London CTRL hubs, Ebbsfleet and Ashford, are described with an introduction to the geographical and socio-economic context that sets them apart so as to provide contrasting case-studies. Four post-project impact studies are summarised to illustrate the evidence and evaluation conclusions reached regarding the project so far. Finally the temporal and spatial boundaries of the hubs is defined and the reasoning behind these choices given. The social elements of the two hubs are explored in great detail within the central GIS-based analyses (chapters 7 and 8). The following chapter introduces the interpretive framework with which to comprehend and manage the potential social impacts, discussed in chapter 2, at these CTRL hubs.

6.

The interpretive framework:**Systems theory**

“In general, complexity and precision bear an inverse relation to one another in the sense that, as the complexity of the problem increases, the possibility of analysing it in precise terms diminishes” Zadeh quoted in Jain (1980:129)

This chapter aims to explain the cause and effect relationships between variables, that is the characteristics or attributes of the case-study populations at the CTRL hubs. In coming to an understanding of how these impacts occurred, and in anticipation that there can be lessons learnt for decision-makers, a systems thinking approach has been adopted. This chapter begins with a brief overview of systems thinking and how elements of this method relate to the case-study, before considering the ontological spheres of order, complexity and chaos in decision-making within MUDP planning and implementation. The *Cynefin* framework (Kurtz and Snowden 2003) is explored with the aim of linking decision-making strategies with impact identification and management, and applications to the case-study. A simple visualisation technique, the ‘Seven Samurai of Systems Engineering’, is used to position the social impacts of the CTRL within a comprehensive planning and socio-political systems environment, and finally a discussion regarding systems thinking and the hypotheses and research questions closes the chapter.

Systems Thinking

The meta-disciplinary ‘systems thinking’ approach is adopted as the epistemological standpoint because it encapsulates the complexity of dynamic interactions between the multiple agents involved in the planning and implementation of the MUDP (and the associated developments) under study, and forms a framework for viewing the impacts mapped by the indicator set as outcomes of many processes. Furthermore, systems theory is an appropriate tool for decision-making support systems that generally perform sub-optimally if adopting the ‘conventional solution-gear approach’ (Vriens and Hendricks 1997:25-27) that lacks the facility to take multiple perspectives upon a problem (Seddon 2008:68). It is clear that the creation of this case study system is however subjective from my viewpoint as observer/describer, and could have many different variations.

In general, a pure multi-agent system consists of four basic elements. The first is considered to be variables (parts/elements within the system that are either intangible and/or physical). In this case study, this constitutes the planning and delivery of the CTRL, the various levels of government involved in that process, the stakeholders and the communities at the hubs of

Ebbfleet and Ashford. The second elements of a system are the properties or attributes of variables of the system, such as demographic profiles and spatial configurations of the hubs, as well as cultural motivation, socio-political influences and economic pressures within the various organisations. Thirdly, a system has internal interactions amongst its variables; complex links that describe the relationships and the ability one part has to manipulate others. The performance of the system is heavily reliant upon a multitude of decisions made by stakeholders at every level and is subject to both co-operation via formal command structures and informal trust networks, and competition or friction between them. The system therefore needs to be flexible in response to the changing environment (Waldrop 1994, Kurtz and Snowden 2003:465). Feedback loops are an important type of interaction relationship as they influence future patterns of behaviour and decision-making (Seel 1999:2). Lastly, the system exists in an environment, considered to be the system context and represents more than the sum of its parts, although this distinction is purely contextual rather than absolute (Batty 2005:35). The system environment of this research is the case-study MUTP and hubs, and inherently acknowledges that there are many infinite, unknowable factors which contribute to the impacts of the CTRL on the communities over time within this environment (Checkland 1981:101-2).

More sophisticated systems such as 'Complex Adaptive Systems' have several pertinent characteristics over and above pure multi-agent systems that can be related to the case-study. The first is that these systems can be considered to be constructed of recursive 'nested' systems; the 'holonic' concept; both of larger suprasystems and smaller sub-systems, each with their own elements of simplicity or complexity (Seel 1999:3). With this in mind, it would be possible to imagine the systems inherent in this research context comprising of smaller local, short-lived systems concerned with the micro-level details and similarly how the case-study system nests into the regional and national systems of transport planning. All of these function in different ways with a wide scope of pressures and influences that impact upon the decisions made and co-evolve as time passes (Chapman 2004:39, Oades 2008). One outcome of this is the lack of a single centralised element of the system in control of the process of events, and that agents within the systems are 'enablers of change' (Seel 1999:3-5). Adaptive systems are typically more stable due to their inherent ability to self-organise the structure in the wake of macro-environmental changes (Bertalanffy 1968:46-48, Vriens and Hendricks 1997:27-8). They evolve continuously, their states being irreversible and thereby historical in nature (Byrne 1997b:2).

Complexity in systems of the social world lead to the production or output of 'emergent' properties which are not wholly controlled by the mechanics of the system's parts (Lewin 1993:172-196). This Aristotelian concept that the whole is more than the sum of its parts is present in this case-study as the socio-cultural political and economic contexts change continually in unpredictable ways. This leads the relatively known or knowable outputs of the

MUTP planning process such as the design, construction, delivery and operation details to diversify. This can lead to unplanned and therefore relatively chaotic outcomes to form and together lead to spontaneous 'emergent order' impacts that are process driven (Oades 2008:14). This emergent order is hard to define before it happens:

"...the complex whole may exhibit properties that are not readily explained by understanding its parts. The complex whole, in a completely non-mystical sense, can often exhibit collective properties, "emergent" features that are lawful in their own right." (Kauffman 1996:vii-viii)

It is this acceptance of an emergent order that defines a systems approach to complexity versus that of a reductionist approach. This latter standpoint assumes that complexity can be continuously deconstructed into smaller issues or problems until they become simplified enough to comprehend and answer (Descartes cited in Checkland (1981:100)). It therefore lacks the understanding of the relationships, that is the rich interconnectedness between components (such as the MUTP stakeholders that facilitate control and communication), inherent in complex systems that influence those components of the system (Bertalanffy 1968:37, Kurtz and Snowden 2003:462, Chapman 2004:54). The reductionist approach is also sometimes adopted in order to quantify a system's performance, as is common in public policy assessments but often such a performance indicator, such as cost-benefit analyses, may only highlight very few of the system's outputs and outcomes, distorting the real picture (Chapman 2004:58-60). However it is inevitable that in quantifying and summarising data in preparation or viewing such data in a GIS environment, some element of 'reductionism' occurs, simplifying greatly the complex influences that have brought about that state of the environment at moments of data capture. An awareness of this, and comprehension that one is viewing a glimpse of shifting dynamic processes, a single part in an infinitely large and small system 'machine' goes some way in adopting an 'adaptive system' viewpoint in this GIS-based indicator set.

The *Cynefin* Framework and the CTRL case-study

Integral to the work being carried out by the Omega Centre team is the adoption of the *Cynefin* framework, created by Kurtz and Snowden (2003). This complexity model takes inspiration from the Welsh word '*Cynefin*' (habitat or place that you belong to which you can only be partially aware of, a place of multiple belongings) and draws upon complex adaptive systems theory, cognitive science and anthropology. This framework can aid in sense-making the properties inherent in dynamic processes and has been utilised in many fields including project management as it claims to be able to recognise the causal difference between various types of systems and proposes the appropriate method with which to respond (Snowden 2007 personal communication). This is done by proposing how decisions should be made in response to processes or events that fall into different domains, with the implicit understanding that there is no hierarchy of preference for the domains; they are simply differing facets of life situations; a spectrum between "simple linearity to absolute indeterminism" (Byrne 1997a:50).

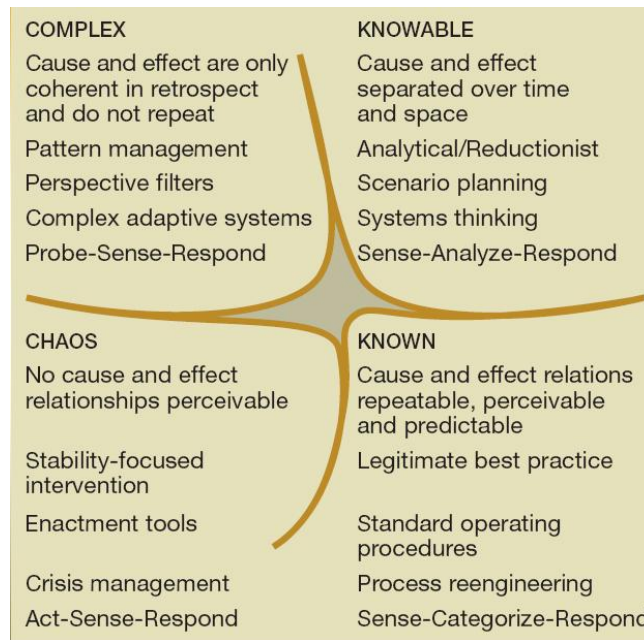


Fig 6.1: *Cynefin* domains (Kurtz and Snowden 2003:468)

This approach is considered of use for post-project evaluation and managing impacts as they happen (guidelines and lessons-learnt for differing facets of social changes at the hubs). Depending upon which domain one is in, decision-makers ought to act and think differently. Relating this to the case-study, one can ascertain that the key characteristics for the 'known' domain in fig. 6.1 above, are linearity and predicable cause and effects outputs, where for example, the construction of the CTRL line haul and its stations, a mega engineering feat, are positioned. The decisions made for processes in this domain should be focused upon sensing incoming data, categorising it with reference to pre-determined categories based upon previous experiences, and responding accordingly with standard (best) practice (Kurtz and Snowden 2003:468). The impacts from these decisions are fairly straightforward to identify in this simple and stable space.

Knowable or complicated domain processes or events in fig. 6.1 above, are more opaque than those completely known, with outcomes of decision being harder to identify. The decision-making process is subjected to more analysis of incoming data by 'experts' before responding appropriately, as the cause-effect relationship is less straightforward. Application of 'good' practice is advisable since this is more adaptive or flexible than 'best' practice when experts analyse the impacts (Kurtz and Snowden 2003:468).

The complex domain of the *Cynefin* framework features more ambiguity in the relationship between cause and effect, where there is an emergent order of the system that bears the attribute of 'retrospective coherence' (Kurtz and Snowden 2003:469). Here the patterns between the cause and effect of the processes are so complex and unpredictable in the details, it is impossible to replicate them in a different context or to take previous outcomes

as a blueprint for the current process. This encapsulates the final 'modified core context'; the social changes that have occurred and re-shaped the CTRL hubs following the delivery of the line haul and service. The MUTP has provided the catalyst for sub-processes and the impacts are possible to identify but unfeasible to attribute to a single decision, although interviews with the key stakeholders to elicit anecdotes and revelations regarding the motivations behind certain decisions could be enlightening (Kurtz and Snowden 2003:469 *ibid*). The strategy for managing impacts and processes that occur in the complex domain is 'Probe-Sense-Respond', whereby planners and decision-makers can experiment with outcomes, and if successful, amplify the experimental approach, and if unsuccessful, dampen it. Planners should not commence an experimental intervention without having an amplifying or dampening strategy already identified (Snowden 2007 personal communication).

It is this complexity that makes it impossible to ever completely attribute causal inference directly to the MUTP, and is an ever-present issue that permeates evaluation and appraisal frameworks across spatial policy planning as 'local neighbourhood spill-over impacts' (Felsenstein et al. 1997). Of relevance, Robson et al. (1994:vii) coined the phrase 'the counterfactual problem', what may have occurred irrespective of public intervention. Conversely when the impact of the policy is undetectable, it is impossible to be sure that this is the result of improper policy implementation, theoretical shortcomings or inappropriate measurements. Central to the premise of this research is that the 'mega' nature of the MUTP lends itself to opportunities, where the project acts as a catalyst. Sometimes in latter stages of the delivery of the project, in circumstances unforeseen at the project's inception, many factors belatedly come together in an unpredictable way. This 'sensitivity to initial conditions', where seemingly innocuous small details in the 'early stages' of the process have incrementally larger impacts as time passes are not linear and therefore cannot be predicted in advance (Seel 1999:4). But once these initial conditions have been set and the process commenced, path dependency can develop as a result of positive feedback along a viable trajectory, which reinforces the processes of the complex system (Batty 2005:29).

The complexity of MUTP planning system also breeds 'wicked problems', those issues that are so complex, it is seemingly impossible to understand what the problem is, how to respond and/or resolve it, and to anticipate how much time, effort and cost will be spent addressing it, or even if it *has been* addressed (Conklin 2005:7-9). These types of problems are prevalent in government policy in all spheres, including those faced by decision-makers regarding planning issues, and are characterised by being unique due to the configuration and work culture of those involved and their interactions at any singular moment (Chapman 2004:36, Conklin 2005:9). It is important to recognise that decision-making in the realm of MUTP planning, whilst fraught with wicked problems, must nonetheless adopt an opportunity-driven approach in order to achieve the objectives. Wicked problems are not

solvable by passive data gathering and analysis, as important data related to the problem cannot be generated until implementation has commenced, providing feedback (Conklin 2005:10). Decision-makers may need to consider the problem at many different levels of abstraction in order to start forming a viable solution (Vriens and Hendricks 1997:32-3). Indeed this level of uncertainty generated by dealing with wicked problems leads to an element of chaos in the system which in turn provides the system with a vibrancy and creativity to adapt and improve through feedback and lessons-learnt (Kurtz and Snowden 2003:464, Fryer 2009). Complexity can be modelled via cellular automata, neural nets and so forth (Seel 1999:1) but these are a little too specific and have not been incorporated into the indicator set.

The domain of Chaotic processes or events is unstable and the relationship between cause and effect is unknowable to decision-makers who have no choice but to respond decisively to stabilise a chaotic situation, gauge reactions and act upon those responses to try to bring some form of order (Act-Sense-Respond), giving rise to the notion that order is an emergent property of chaos (Byrne 1997a:52). The factors that can either move a system towards or away from the 'edge of chaos' are the levels of agent connectivity, diversity of agents or the relationships between them and information flow (Seel 1999:5). The impact indicators do not provide for such events although it is possible that there are social impacts to chaotic events such as flooding of the Ebbsfleet Valley, bankruptcy of any of the stakeholders, or a major accident on the train line. One could decide to move into this domain deliberately as a way of sparking innovation and novel practices are forged, but to find oneself in this domain through complacency and lack of appreciation of the processes' vulnerability could become an expensive recovery experience to be avoided (Snowden 2007 pers. comm.).

The final domain, visualised as the grey space in the centre of the other domains (in fig 6.1 above), depicts disorder where there is conflict between decision-makers and different perspectives are needed to resolve the situation. Processes here are sometimes made of many domains and it is necessary to disaggregate to clarify how to act appropriately (Kurtz and Snowden 2003:470).

Soft Systems Methodology (SSM) was pioneered by Checkland (1981) to distinguish systems thinking in 'harder' disciplines such as engineering or computing, to social systems and the inherent complexities that people bring to such a system.

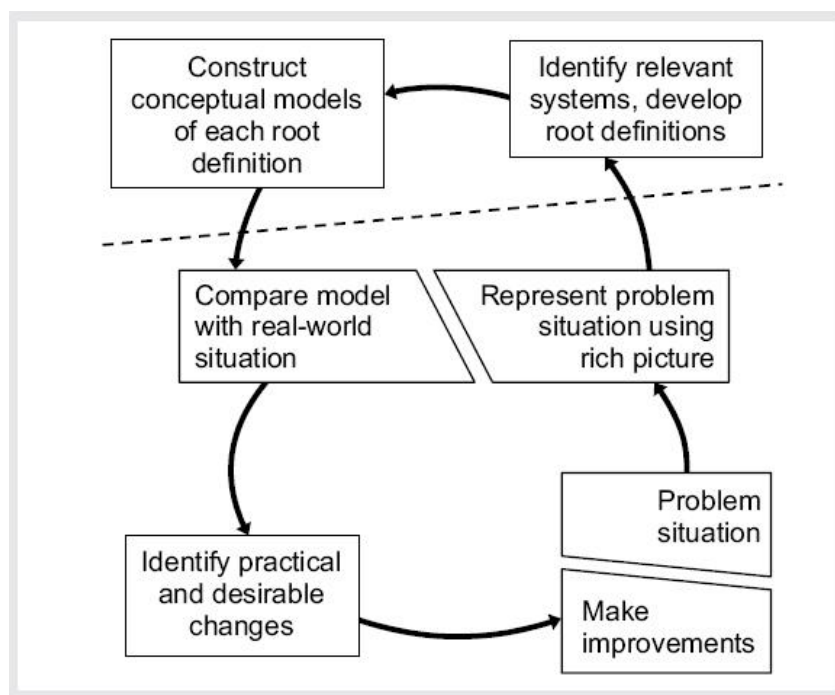


Fig. 6.2: The seven-step process of SSM (Chapman 2004:76)

The methodology encourages systems thinking for the process of *inquiry* as illustrated by fig. 6.2 above. This approach is beneficial in exploring systems with wicked problems or chaotic domain processes as it accepts that there are differing motivations, cultures and perspectives within the system and can deal with a level of ambiguity that these relationships often carry (Chapman 2004:40-41). In public policy, attempting to consider the issues that the policy aims to address is laden with subjectivity, which this methodology can go towards neutralising by providing a framework within which to consider ‘systems of interest’ from several points of view (Chapman 2004:42-43). SSM is also useful in utilising others’ perspectives regarding problems or issues when implementation does not go quite to plan, possibly due to poor policy designs that fail to accept the reality of the delivery (Chapman 2004:43).

The application of the *Cynefin* framework is discussed as part of ‘future guidelines and lessons learnt for planners and decision-makers’ in each of the indicators that form the main indicator set, suggesting possible strategies for understanding and responding to each impact.

Seven Samurai of Systems Thinking

By adopting the simple visualisation method of the Seven Samurai of Systems Engineering (fig. 6.3 below, adapted from Martin 2004), it is possible to explore the tensions and interactions (inputs/outputs in systems thinking) between both institutions and processes at work in the case-study. It is possible to then work towards a holistic view of the causes and possible effects (text in grey in fig. 6.3) that these interactions have. The Seven Samurai

approach is straightforward enough to sketch upon paper, negating the need for more sophisticated visualisation tools such as Gephi or Pajek.

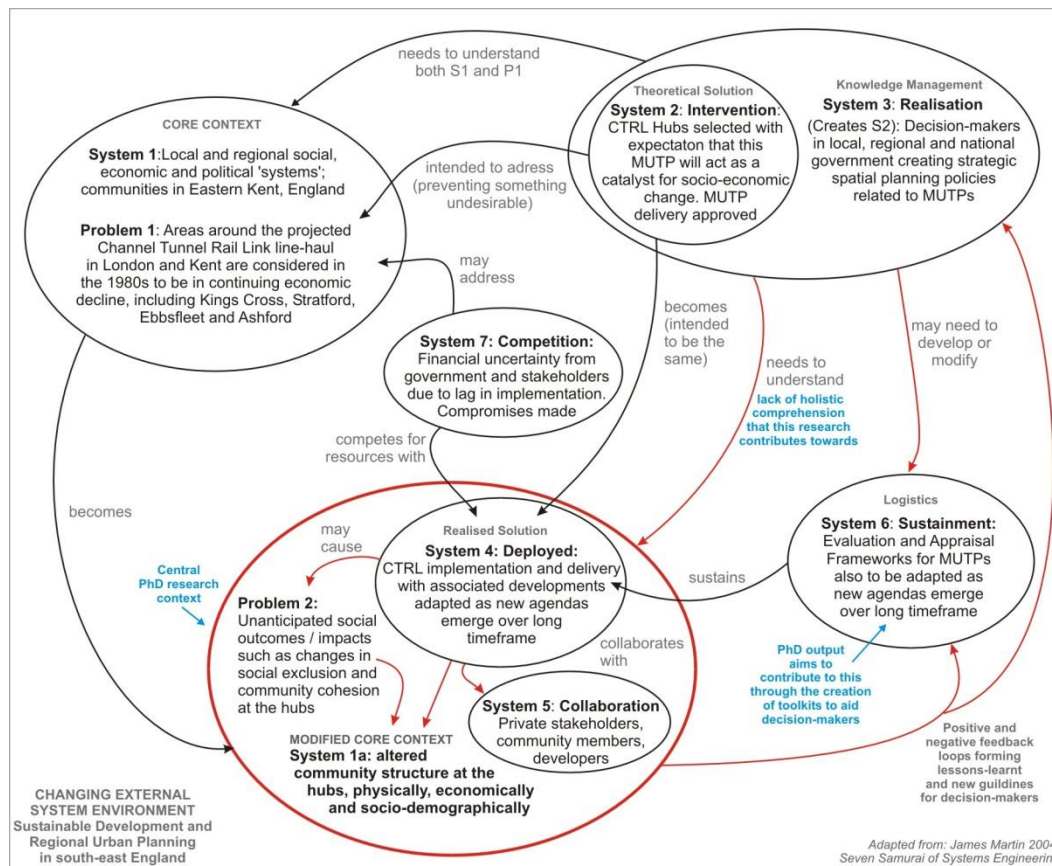


Fig. 6.3: The 'Seven Samurai of Systems Engineering': MUTP Impacts and the planning process

Adapted from: Martin (2004)

The above entity relationship attributes diagram of the complex adaptive system defines one of many possible scopes of the issues to be explored, and, where the arrows are in red, indicates the most significant relationships that the impact indicator set needs to respond to. This approach provides context and reason for the output of the impact indicators as discussed in the findings sub-sections. Within this framework 'known', 'knowable' and 'complex' relationships and processes are present, and some of the system agents and interactions can fluctuate between two or more states. The Seven Samurai approach does not however have chaotic or disorderly domains depicted, as these are characterised by being unpredictable and liable to occur randomly. This is a feature of an open system that has fluid or porous boundaries, impacted by external influences.

The first interaction can be considered to be between the Context System (S1) and Problem 1 (P1); the state of the hub communities (Kings Cross, Stratford and Ebbsfleet in particular) *before* the implementation of the final choice of rail link in the early 1980s. The east-end of London and the area that has since become the Thames Gateway were areas of relative deprivation and considered to be good potential areas for regeneration (D.o.E. 1995). The

second interaction is between System 2 (S2) the theoretical solution, and Problem 1 (P1). In this framework, this is the selection by decision-makers (S3) of the line-haul and hubs and early plans to develop the Thames Gateway, and the expectation that the intended impacts will lead to long-term benefits to those communities. The third interaction is the nested relationship between the theoretical solution (S2) and the realisation system (S3), the process that brings the MUTP into being. This realisation system involves local, regional and national government, and consists of the people, the organisations, policy, procedures, data, wisdom, knowledge and information relevant to the problem. Interaction four is the link between the theoretical and realisation systems (S2 and S3), which is politically charged and shaped by cultural and economic influences current at any single time. This is subject to changes in government and wider agendas that emerge over the long timeframe that this MUTP experiences from planning stages (1974-1996) to delivery (November 2007), around 22 years.

Interaction five can be considered as the decision- and policy-makers arena at various levels of government that understand the local and regional issues (S1 and P1) relating to the hubs and can influence how the MUTP is implemented to maximise intended benefits at the hubs. This however, is not necessarily the dominant strategy; there are bottom-up as well as top-down influences regarding policy making (Seddon 2008:67-70) The sixth interaction is the ability of these decision-makers and policy shapers to understand the 'modified core context' (System 1a), that is the range of impacts, simple to complex, and changes that the hubs have experienced during and subsequent to the MUTP implementation. The social impacts for non-users are currently excluded from this critical interaction and are the research focus of this PhD. The seventh interaction is the need for the realisation system (S3: decision-makers in government), to develop and/or modify the Sustainment System (S6), which is considered to be the evaluation and appraisal frameworks. The output from this PhD aims to enrich this area by providing decision-makers with new tools with which to explore social impacts, and providing lessons-learnt and guidelines for future appraisals and evaluation frameworks.

Interaction eight is the process of the theoretical intervention system (S2) becoming the deployed system (S4). This entails the delivery of the MUTP, and the realisation of the impacts of the associated developments for which the MUTP provided the main catalyst. This assumes initially that there were no unexpected problems or amendments to the plans, as the deployed system is intended to be the same as the theoretical system. Deviations inevitably occur due to unpredictable deployment pressures or interactions between all the systems. The ninth interaction is the important relationship between the deployed and collaborating (S5) systems which include private stakeholders, community members and the developers where each have both disparate and overlapping agendas regarding the impacts (both costs and benefits) that the delivery of the MUTP will lead to (Kurtz and Snowden

2003:464). Here alliances form and reform, tensions and emotion inevitably influence the relationships (Checkland 1981:120). The short and long-term sustainment of the deployed system (S4) by the evaluation frameworks (S6) forms interaction ten. This is realised by the appraisal and evaluation of the continued impacts of the MUDP and associated developments after the delivery of the MUDP, and the creation of policies that relate to ensuring maximum benefits are reaped by the communities.

Interaction eleven is a significant relationship as it implies that the deployed system may cause unanticipated outcomes considered as Problem 2, and is a fundamental element of the modified core context (S1a). This follows from Norton's "Law of Unintended Consequences"; actions of people and governments that have unanticipated outcomes which are known about by social scientists and economists such as Smith's "invisible hand" and Bastiat's "What is Seen and What is Not Seen" (Mainzer 1994:259-270). This effect is often ignored by politicians, leading to spiralling costs and instances where government initiatives become counterproductive in the longer term. It should be noted that there are also unintended yet not unforeseen consequences to decisions made, where the desire for progress accepts the chances these unintentional outcomes could manifest (Norton 2008). It is these impacts which are to be mitigated and that the GIS indicator set could aid in assessments at the planning stages. Interaction 12 is the competition for resources (S7) with the deployed system, which could involve the turbulent financial situation, which can at times become precarious due to the long timeframe that the MUDP takes to deliver. As unexpected costs arise, or financial support is scaled back or withdrawn from some stakeholders (as a result of an economic recession for example), compromises are made to ensure that the project is completed in some form. Strategies for managing political and financial risk and uncertainty become increasingly relevant if the environment becomes evermore unstable (Omega Centre 2007b).

The thirteenth relationship acknowledges that this competition for resources that leads to amendments to the deployed system may still address the original problem, as the compromises can be made with more insight into how the project is unfolding during the implementation, hence this represents a form of feedback. Relationship 14 is the integration of the deployed system. Here it is the implementation and delivery of the CTRL and the modification of the core context, i.e. the communities at Ebbsfleet and Ashford once the CTRL is completed. This is the root of the impact indicator set which explores the effect that the rail link has had on the community as a whole. The penultimate interaction is the supplantation by the modified core context (system 1a) of the original context as the deployed system alters it in both knowable (predictable) and complex (unpredictable) ways. This can be considered the central 'emergent' property of the system.

The final interaction is the important feedback loop between the modified core context (S1a), the sustainment system (S6) and the realisation system (S3), consisting of positive (amplifying and therefore self-reinforcing) and negative (dampening or self-correcting) feedback. This in turn generates lessons-learnt for the decision-makers and contributes towards subsequent policy frameworks regarding MUTP planning.

Feedback loops are integral to the work of systems theorists von Foerster and Luhmann particularly the notion of 'second order observations'. Being one-step removed from the direct world observations in theory presents one with the ability not only to see issues but critique and assess how one sees them giving valuable insights into influences beyond the immediate environment (Beyes 2005). A derived double-loop learning model (fig. 6.4 below) was developed by Argyris and Schön (1974), whereby single loop learning was both best practice when all worked well and was easily repeatable (i.e. in the simple process domain), but worst practice when mistakes were repeated and nothing was learnt (that is, processes and impacts in other domains that were not appropriately managed). Hence this second feedback loop provides the chance to consider the objectives and values inherent in the response action and to break any negative patterns which form (Argyris and Schön 1974).

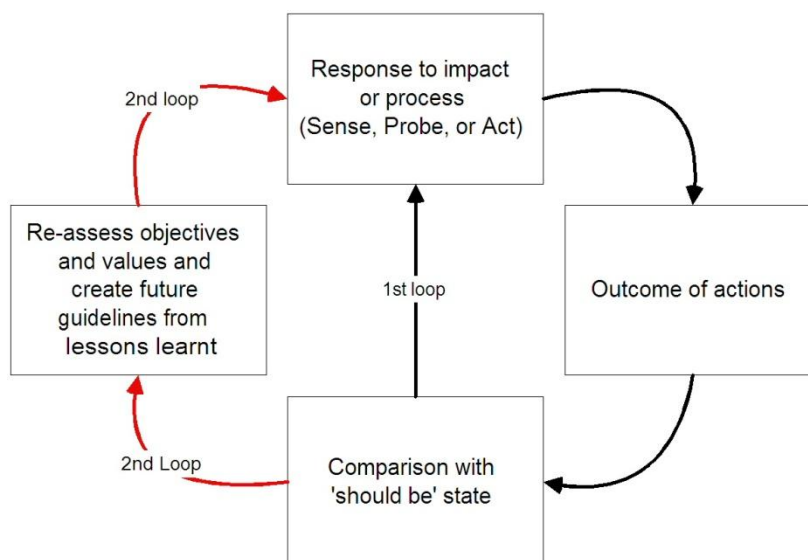


Fig 6.4: Double Loop learning example for MUTP impacts (derived from Tschäppeler and Krogerus 2011)

The use of the above approaches could provide the planners and decision-makers tools with which to incorporate emerging agendas that become new priorities through the long planning timeframe of MUTPs. The sustainability agenda has come more to the fore since the inception of the CTRL, as discussed in the literature review above (chapter 2.1). Absorbing these new goals into the programme of deliverable outcomes of the MUTP required the planners to re-assess their management of the processes both underway, and those to be commenced. The GIS indicator set provide a means for 'double-loop learning' in the future planning and appraisal of MUTPs, so as to reduce the risk of adverse impacts to non-users

that could occur by providing multi-scalar, multi-faceted socio-economic profiles of the hubs over time.

The interpretative framework and research questions

The research objectives assess the impact indicators from a range of contexts and also consider if 'context is everything'. Utilising a systems thinking process, one can appreciate that even from a single geographical or temporal context, processes are multi-faceted and can only sometimes be broken down in the ontological spheres as described by the *Cynefin* framework. The contexts for the planning and implementation of an MUTP are fluid and a small part of many inter-related socio-political systems. In answering 'what constitutes a successful MUTP' an overview of the hypothesised extent of a system detailed in the Seven Samurai, how well it functioned and the state of the modified core context is a useful start in broaching this very complex question.

The initial question is concerned with the GIS and the impacts, and alludes to the different ontological states of first order impacts which are planned outputs and can be considered as 'known', and the second order impacts that can be either planned or unplanned and range from knowable to complex, and even chaotic with little causal inference possible. The latter are still important as they form a significant element of change for which the MUTP has provided the catalyst. The interpretive framework indicates to the decision-makers and local planners one way to interpret the maps and how to act upon those interpretations. The second research question touches upon how known or knowable MUTP impacts can increase or decrease the risks of complex 'meta-processes' such as community cohesion and social exclusion, which are hard to assess directly. Here both the inputs and subsequent impacts will be complex, possibly even touching on the disorder domain where clarification, probing and acting will have unpredictable effects, but double-loop learning would hopefully lead to a positive long-term outcome.

This chapter introduced current thinking regarding complex adaptive systems and how this could be of relevance to the field of planning. The *Cynefin* framework, a central element to the use of the indicator set was described and illustrated with aspects of the case study. This decision-making model will support the management of social impacts of the CTRL, which are often fuzzy and uncertain. Finally the Seven Samurai of Systems Engineering was presented as a means of visualising the complexity of the impact process, and the fluid and porous political context that the indicator set would operate within.

This completes the general overview of the context for the use of the indicator set and management of the perceived outcomes displayed within the GIS maps. Subsequent chapters now focus upon the practical creation and exploration of the social impact indicators as a 'proof of concept' for the proposed methodology.

7.

The social impact indicator set:**Introduction to the indicators**

“Regeneration is the most powerful demonstration of the value of investing in high speed rail. This is not just about track and trains - this is about how a railway line can change geography. People will experience the benefits of HS1 even if they never set foot on a train.” David Joy, London & Continental Railways (2011)

Within chapter 7 there are five separate indicators (comprising eleven sub-indicators). The Combined Score and two further ‘meta theme’ indicators, formed from a variety of combinations of these 11 sub-indicators, are located in the subsequent chapter 8.

The five main indicator set inputs and their associated sub-indicators are

1. *Demographic profiles*: Index of Diversity sub-indicator
2. *Socio-economic Deprivation*: Multiple Deprivation and Geographical Barriers sub-indicators
3. *Accessibility measures*: Transport Needs Index and potential gravity model sub-indicators
4. *Physical Barriers*: Neighbourhood Division, Community Segregation, Spatial Confinement & Impeded Access to local facilities sub-indicators
5. *Journey to work*: Origin-Destination workplace flows and Mode usage sub-indicators

This chapter is divided into five sub-chapters, one per main impact indicator listed above. Each of these sub-chapters contains three sub-sections: a) methodology, b) data inputs and map outputs, and c) findings of that indicator. A detailed outline of each sub-section is as follows.

A) The methodology commences with a brief introduction to the indicator theme, discussing why it is important for planners and decision-makers to know about this indicator, especially for planning, appraising and evaluating MUTPs. Specific relevance to the case-study hubs is highlighted. This is followed by the aim of the indicator; how do the indicator variables change as a potential impact of an MUTP and what social benefits could a planner or decision-maker aim to achieve with the help of the MUTP as a catalyst. Subsequently, the indicator objectives are covered in brief: what dataset inputs should help achieve the aim, and why these are chosen. This is followed by a full discussion of the method for creating each indicator. Future guidelines for planners and decision-makers are suggested as they are hoped to be extracted from the sub-indicator outputs (i.e. the maps and associated charts). Potential ‘lessons learnt’ for planners and decision-makers are considered, particularly if the lessons are generic and/or context specific, and this is with strong reference to *Cynefin* decision-making framework described above in the interpretative

framework (chapter 6). The methodology section closes with a brief consideration if and how the indicator has any cross influence with the 'meta themes' of cohesion and exclusion.

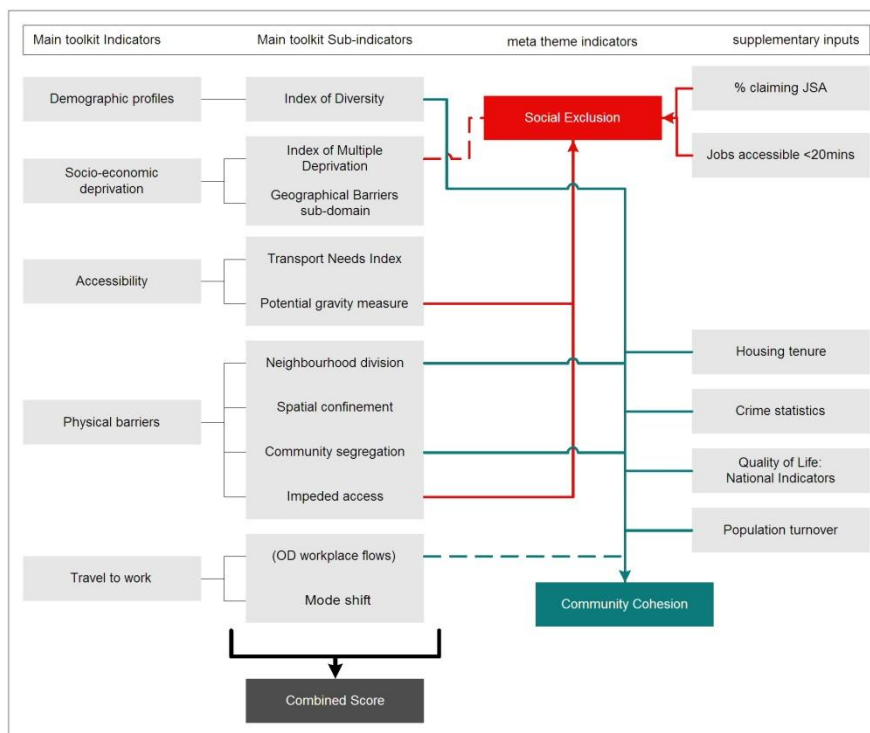


Fig. 7.1: Influences between the main indicator set input data in this chapter, and the Combined Score and Meta Themes indicators in chapter 8.

B) This is followed by the main data inputs and map outputs section, clarifying how the data are processed and how and why any unanticipated issues are overcome, with commentary upon the spatial patterning in the maps. In this section, Ashford is presented first as a relatively less impacted hub so as to emphasise the extensive changes undergone within the main case study hub, Ebbsfleet.

C) The indicator sub-section closes with the findings of the indicator, interpretation of the maps with a view to responding to the aims and objectives, its strengths and weaknesses, and a critical assessment of the method. Also included is a brief discussion regarding what lessons can be learnt and suggestions of future guidelines for decision-makers, which provides an understanding of how such an indicator could be of value in a real-world context.

For each indicator set input above, the MUTP delivery is the constant in the environment (albeit complex and complicated, over a long timeframe) and the sub-indicators are the variables that are affected or impacted to some extent by the MUTP implementation; the question is by how much? Can a GIS-based indicator set elucidate those impacts? In exploring these key indicators, the section findings seek to establish if these processes are mappable in a way that is of use to planners and decision-makers involved in the planning,

appraising and evaluation of an MUDP such as the Channel Tunnel Rail Link. In creating this impact indicator set, no presumption is made that these analyses are not being carried out in some shape or form by planners and/or decision-makers at various stages of the planning and implementation of an MUDP, but the endeavour of this indicator set is to enable a holistic view of many potential socially-related MUDP outcomes together along with the *Cynefin* decision-making framework to manage impacts.

Two spatial analytical issues are present throughout the creation of the sub-indicators, that of the ecological fallacy, and the Modifiable Areal Unit Problem (MAUP). One should be cautious of the phenomena of 'ecological fallacy' whereby there is an implicit assumption that all that fall within a defined areal unit of a certain attribute necessarily equally share that attribute, for example; all the population within a LSOA are equally deprived (Senior 2002:125).

There are caveats to using aggregated data although it is more widely available, as using it will inevitably lead to error both conceptually - in the form of the risk of ecological fallacy mentioned above - and technically, since measuring from a centroid of a polygon can cause spatial discrepancies. This is associated with the Modifiable Areal Unit Problem due to representing geographical areas with different digital boundaries leading to the scale of analysis and spatial unit definition having an effect on the output (Fotheringham and Wong 1991:1025–1044, Horner and Murray 2002:133-35). This can affect the output of some studies quite significantly. For example, excess commuting in Los Angeles could vary from 44-70% depending on the choice of the zone size (Frost et al. 1998:531). The MAUP is most pronounced when analyses involve measuring distance from or between areal units, which are often represented as unweighted polygonal zones with a centroid (Hewko et al. 2002:1186).

Where the ecological fallacy regarding the population attributes and/or the effects of MAUP affects the indicator measure, the specific nature of these distortions are noted and discussed, alongside potential improvements for future hypothetical applications of the methodology.

The first sub-section 7.1, below, is the analysis of the demographic profiles for the hubs.

7.1a

The Demographic Profiles indicator:

Methodology

The issue of demographic profile changes and the impact it has upon the residents is closely related to population turnover and low community cohesion, issues that are covered in a subsequent indicator below (chapter 8.2). These issues are of interest to Ebbsfleet in particular with an existing population, concentrated in a series of small communities along the Thames, potentially experiencing a rapid influx of new people to the area as and when Ebbsfleet Valley is developed, projected over the next twenty years. Establishing the changes in diversity that this introduces to an area, and understanding the potential implications is important in maintaining existing community structures and dissipating any inter-community tension (C.I.C. 2007b)

Demographic classification systems

The division of spatial areas into classes based upon similar socio-economic and physical characteristics emerged following the 1971 census with typologies based on small-scale areas for the whole of Great Britain, such as an early version of the ACORN system. By the mid-1980s, further classifications systems such as MOSAIC and Super Profiles, were released based upon the 1981 census and have all been updated further in subsequent censuses (Brown et al. 2000:20). Following the 2001 census, the Output Area Classification (OAC) typology was published at the smallest publicly available scale, the Output Area, roughly 110 households or around 264 people (Vickers and Rees 2007: 380). The use of geodemographic profiles in both the public and private sectors is diverse, ranging from planning to health and crime statistics (Hirschfield et al. 1995) to customer targeting for specific commercial services such as media advertising (Chapman 2009) where the classification alludes to the dominant lifestyle, earning levels and consumer types located in that space. This is based upon the principle that people living in close proximity tend generally to share a similar standard of living from which one could extrapolate certain expectations about their preferences for goods and aspirations (Vickers and Rees 2007: 380). The assumptions inherent in the typology become the basis for background data in other indicators including accessibility, neighbourhood division, community segregation and community cohesion.

Potential benefits for the MUTP appraisal

The regeneration of the area could lead to the gentrification of deprived areas, and an influx of aspiring households and more optimism in the area.

Aim of the indicator

Planners need to be able to ascertain if the potential level of changing demographics brought about by a relatively rapid influx of a new population attracted to the hub due to the MUTP and/or its associated developments could lead to an alteration in former community structures. This could lead to an increased risk of low community cohesion.

Objectives

To generate demographic profile maps for the hubs at multiple scales (spatial and typological), an Index of Diversity provides a starting baseline dataset with which planners can assess the demographics of the populations at the hubs and the locations of the interface between existing communities and the new proposed residences. Such boundaries can be a cause for concern without empathetic planning (Spain 1992, Billig and Churchman 2003).

Method

This impact indicator utilises the 2001 OAC as the profiling system, which employed principal component analysis in order to divide the 41 raw census variables into three hierarchical clusters; 7 supergroups, 21 groups and 52 subgroups (Vickers and Rees 2006, Williams and Botterill 2006, Vickers and Rees 2007 for more detailed information regarding the creation and definitions of the typology). Earlier geodemographic data is not available, 1991 Super Profile Groups were not publicly published in a digital format (ONS pers. comm. 2008), and ACORN and MOSAIC are commercially available only data. Therefore the 2001 OAC is the first snapshot of these hubs.

In visualising the demographic profiles at OAC SuperGroup and Group level, GIS maps with associated graphs data will be produced for Ebbsfleet, Ashford. Supplementary GIS maps and graphs will also be generated for the SE England Government Office Region (GOR) for a regional comparison but are located within the appendix (10.2). This is followed by the use of Simpson's Index of Diversity - adjusted by Gibbs & Martin (1962) for use in demographic studies - for the two hubs, to consider the diversity of the socio-economic population particularly around the new Ebbsfleet Valley development. The use of Simpson's Index of Diversity provides a simple metric with which to quantify the level that the variability of social groups changes over the course of time from the inception of an MUTP through delivery, and the years through which the impact continues in hypothetical applications of the indicator set for evaluation purposes.

The Simpson's Index of Diversity is calculated as follows:

$$D = 1 - \sum (n/N)^2$$

where n = total number of a particular OAC group per ward the 10km analysis zone and N = total number of all OAC groups in the ward.

A high value (closer to 1) indicates a high level of diversity and closer to zero an indication of a more homogenous population. This form of the index represents the probability that two individuals randomly selected from a ward will belong to different social (OAC) groups. As the Ebbsfleet Valley development is yet to be constructed, there is of course no relatively rapid large-scale inflow migration of new and potentially demographically different population to assess as yet, hence the diversity index is taken as a baseline *ex-ante* snapshot of demographic diversity from 2001 in the final Combined Score indicator (discussed in more detail in chapter 8.1 below).

Future guidelines for planners and decision-makers

It is hoped that an increased understanding of the demographic make-up of the hubs and the spatial distribution of the different demographic classes will aid planners to maintain and improve intra- and inter-community cohesion as the MUDP is implemented

Lessons Learnt for planners & decision-makers

The changes in demographic diversity are a 'complex' process, one which has limited perceptibility between the multiple causes and short to long term effects. The emergent patterns are difficult if not impossible to recreate in another context, hence management of the changes are guided by a case-by-case basis. Comparison between the Ashford and Ebbsfleet hubs provides the chance to consider the patterns of change to be context specific, or to have an underlying generic relationship.

Cross-influence with meta themes

This indicator is also an input variable in the Community Cohesion indicator (chapter 8.2), whereby increased diversity (here at intra-ward level) increases the risk of low cohesion between residents in a neighbourhood (McPherson and Smith-Lovin 2002, Kossinets and Watts 2009).

7.1b

The Demographic Profile indicator: Input data and output maps

The demographic profile

Ashford

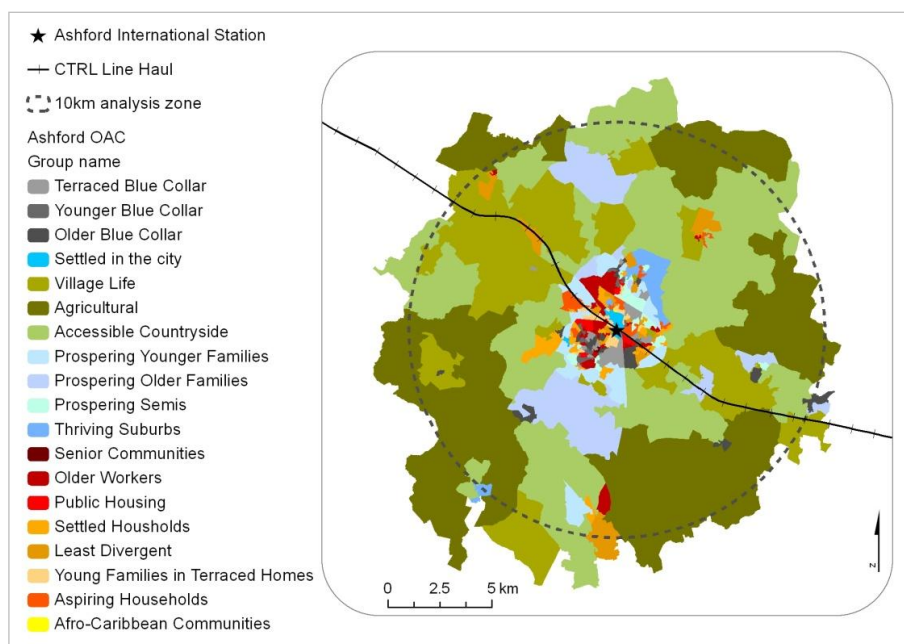


Fig. 7.2: Ashford OAC Group: 10km analysis zone map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

The 10km analysis zone encircling the Ashford hub comprises 18 different Output Area Classification (OAC) groups, seemingly dominated by large tracts of 'Agricultural' and 'Accessible Countryside' Output Areas (OAs) with a small core of urbanised space (fig. 7.2). The vertical bar chart (fig. 7.4) clarifies however that this zone has the greatest number of population living in OAs classes as Prospering Younger Families (Group 4a) and not great differences between the other groups except for very low numbers in Settled in the City, Senior Communities and Afro-Caribbean OAC groups.

A closer examination of the central 3km analysis zone (fig 7.3 below) reveals that many of the OAs are relatively small, with over a quarter under 5ha (compared with the largest in the 10km zone at over 2,200ha), indicating a higher density of population. The Settled in the City OAs are located directly around the station, surrounded by a ring of Settled Households and Older Workers along with Blue Collar Workers and Young Families in Terraced Housing. The largest OA Groups; Prospering Younger Families and Prospering Semis typify the fringe of the analysis zone. Fig. 7.5 provides comparative proportions to the 10km zone.

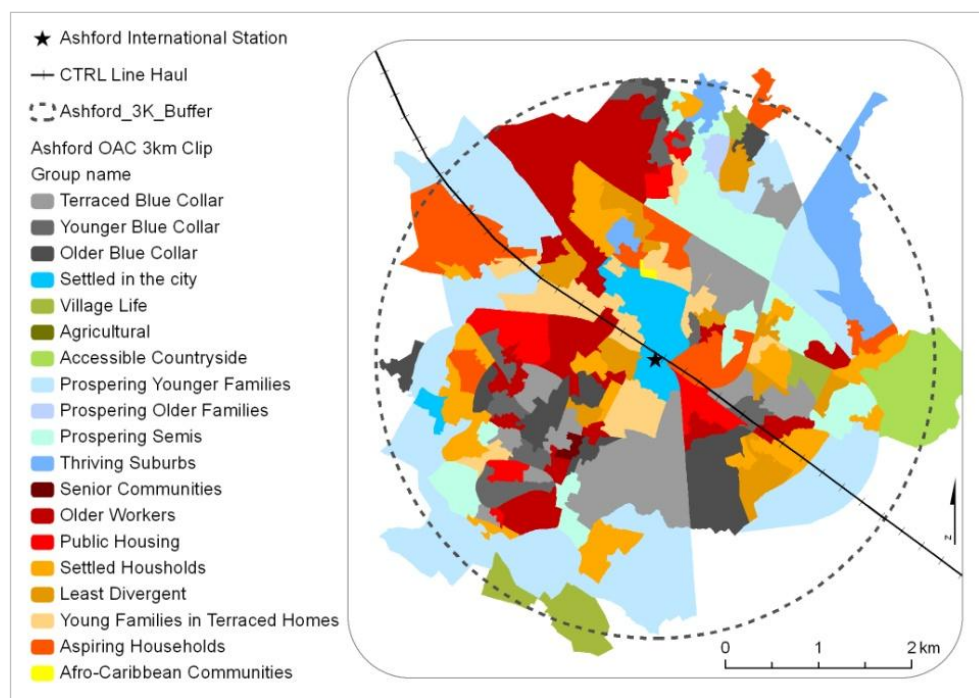


Fig. 7.3: Ashford OAC Group: 3km analysis zone map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

Fig 7.4 & 7.5 (below) associated OAC bar charts for Ashford 3km and 10km

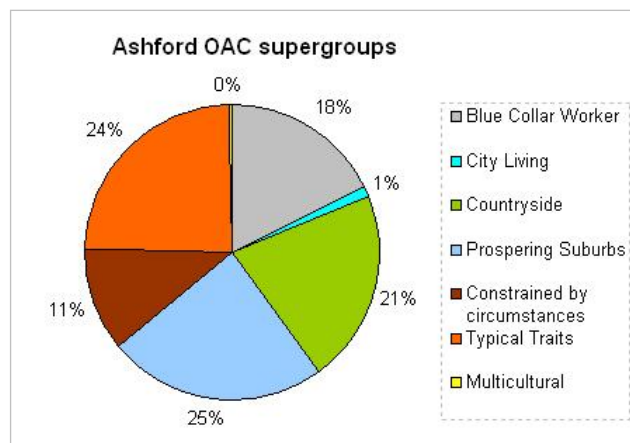
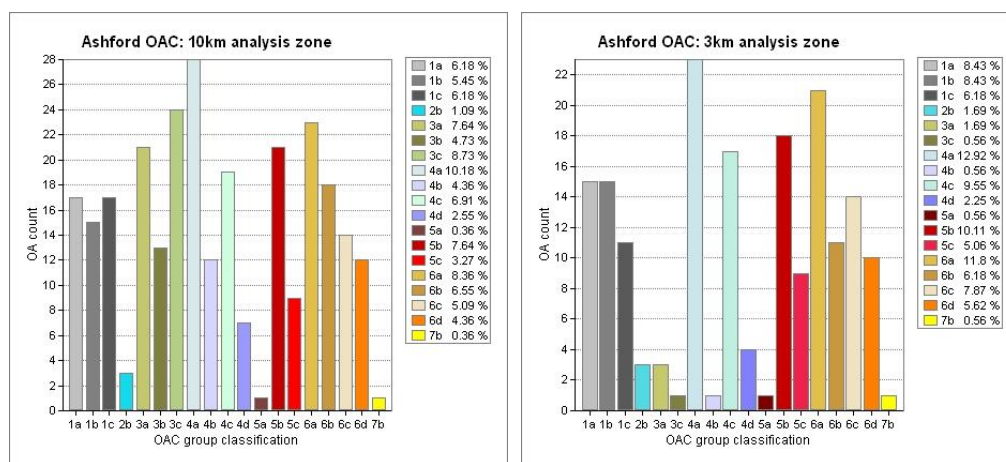


Fig 7.6: Ashford 10km supergroup pie chart

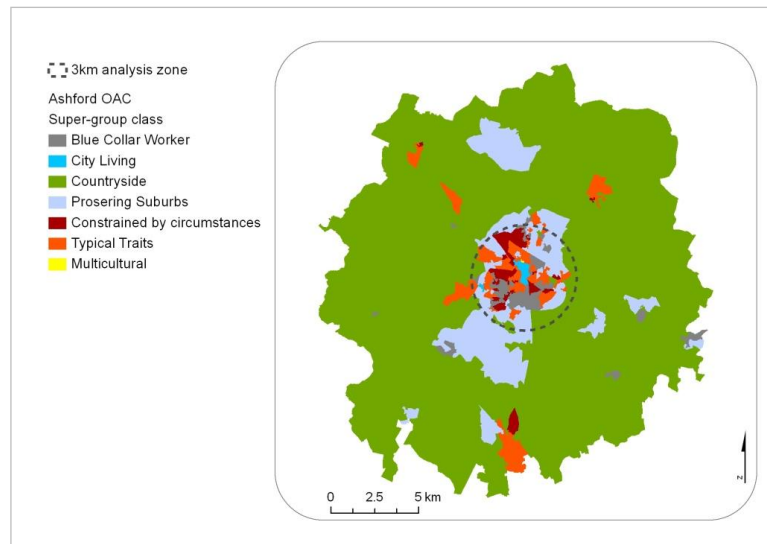


Fig. 7.7: Ashford OAC SuperGroup: 10km analysis zone map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

At a coarser classification resolution, 'supergroup' it emerges that the zone has approximately 50% of the OAs divided equally between Prospering Suburbs (above average for 2+car household and detached housing) or Typical Traits (above average for Terraced housing), slightly smaller proportions in Countryside (also above average for 2+car household and detached housing) and Blue Collar Worker (also above average for Terraced housing) (see fig 7.7 above and the associated pie-chart fig. 7.6). A significant minority are classed as Constrained by Circumstance (above average for All Flats) with barely any within City Living and Multicultural.

Ebbsfleet

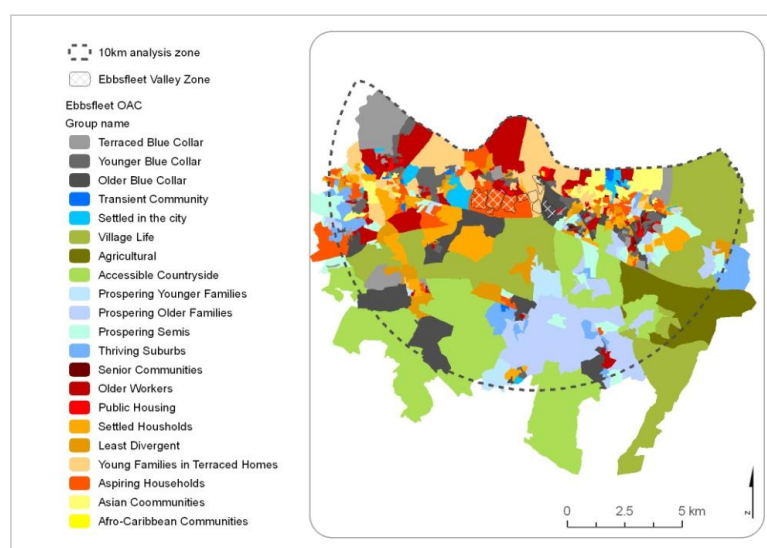


Fig. 7.8: Ebbsfleet OAC Group: 10km analysis zone map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

Ebbsfleet has a different demographic and spatial dispersion of OA classes to Ashford; it is part of the Kent Thameside urban area, and bordering south-east London, so it is not surprising to see that there are much smaller levels of population living in Village Life (1.5%) or Countryside (2%) (fig. 7.10). Instead Younger Families in Terraced Homes, and Settled Households form over a fifth of the total OAs. Older Workers, Younger Blue Collar and Aspiring Households making up another 25% - all of these spatially concentrated along the river front between Dartford and Gravesend with Prospering Older Families (6.8%) and Prospering Semis (7.1%) located in the less densely occupied, more rural southern portion of the analysis zone (fig. 7.8).

The core analysis zone around Ebbsfleet Station has 20% of its OAs classed as Young Families in Terraced Homes, with Older Workers (15%) and Older Blue Collar Workers (11.5%) together making up nearly half of all OAs (fig. 7.11). Ebbsfleet Valley development area has been classed as Aspiring Households despite currently being a chalk pit quarry, along with other new Thameside developments. It is interesting to note that surrounding Ebbsfleet Valley, the OAs are the three main classes; Young Families in Terraced Homes, Older Workers and Older Blue Collar Workers with two OAs in Village Life to the south (fig. 7.9), although this is on the other side of the A2 / A296; major roads that are generally impassable.

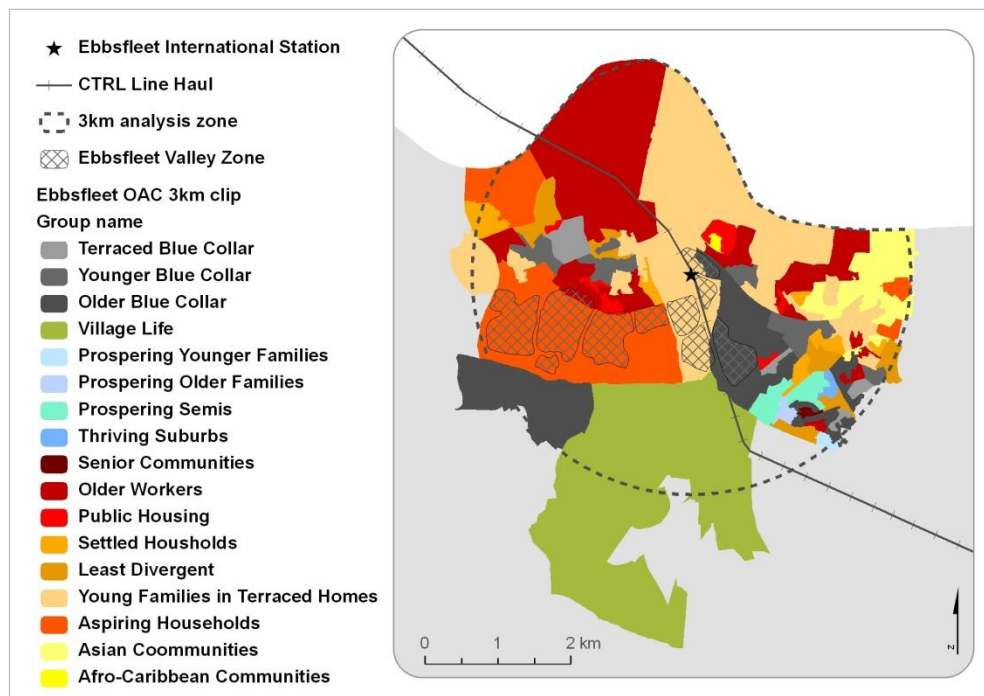


Fig. 7.9: Ebbsfleet OAC Group: 3km analysis zone map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

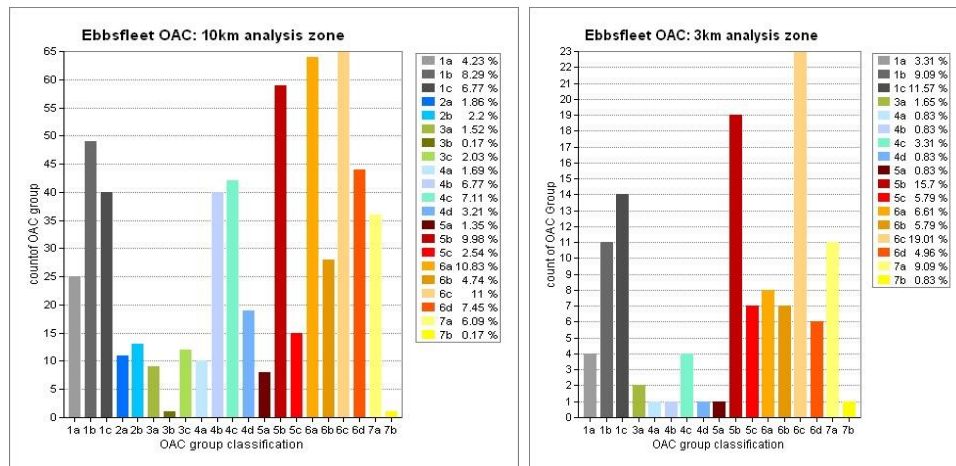


Fig 7.10 & 7.11: Associated OAC bar charts for Ebbsfleet 3km and 10km

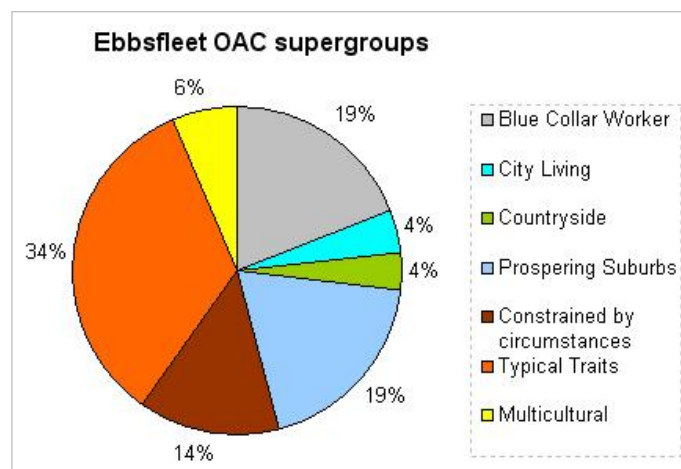


Fig 7.12: Ebbsfleet OAC SuperGroup: 10km pie chart

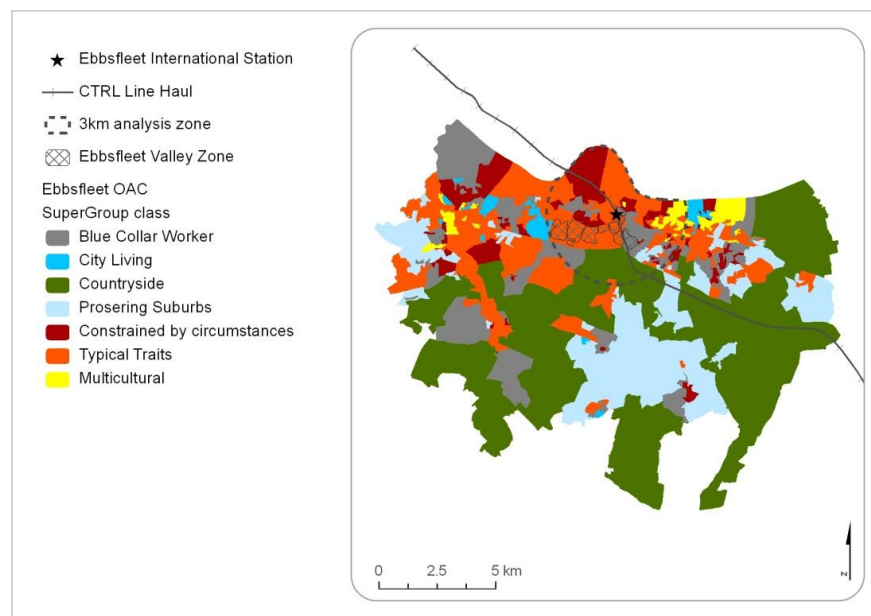


Fig. 7.13: Ebbsfleet OAC SuperGroup: 10km analysis zone map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

At the coarser classification resolution (see Fig. 7.12 and 7.13 above), it becomes clear that over a third of Ebbsfleet's OAs fall into Typical Traits SuperGroup class (above average Terrace Housing) with nearly 20% each in Blue Collar Worker (above average for Terraced Housing) and Prospering Suburbs (above average for Detached Housing and 2+ car households). The 6% Multicultural is predominantly Asian communities in high rise residences in Gravesend to the east, with 4% City Living around the mainline stations of Dartford and Gravesend. Constrained By Circumstances (14%) are often located around industrial or brownfield sites, along or close to the riverfront. A wider regional comparison is made from the South-east England Government Office Region maps and descriptive statistics, located within the Appendix (10.2)

The Index of Diversity

The Index of Diversity value is calculated at intra-ward level to assess the diversity of OAC groups necessary for input into the Combined Score and Meta Theme indicators (in chapter 8). Future applications of the method could easily re-apply the index to LSOA (4-6 OAs) levels of aggregation, or alternatives discussed in the findings section below.

Ashford

Ashford comprises 18 different OAC groups (from a total of 21) covering 178 Output Areas within the 3km analysis zone, with the largest proportion in group 4a 'Prospering Younger Families' at 13% (23 OAs).

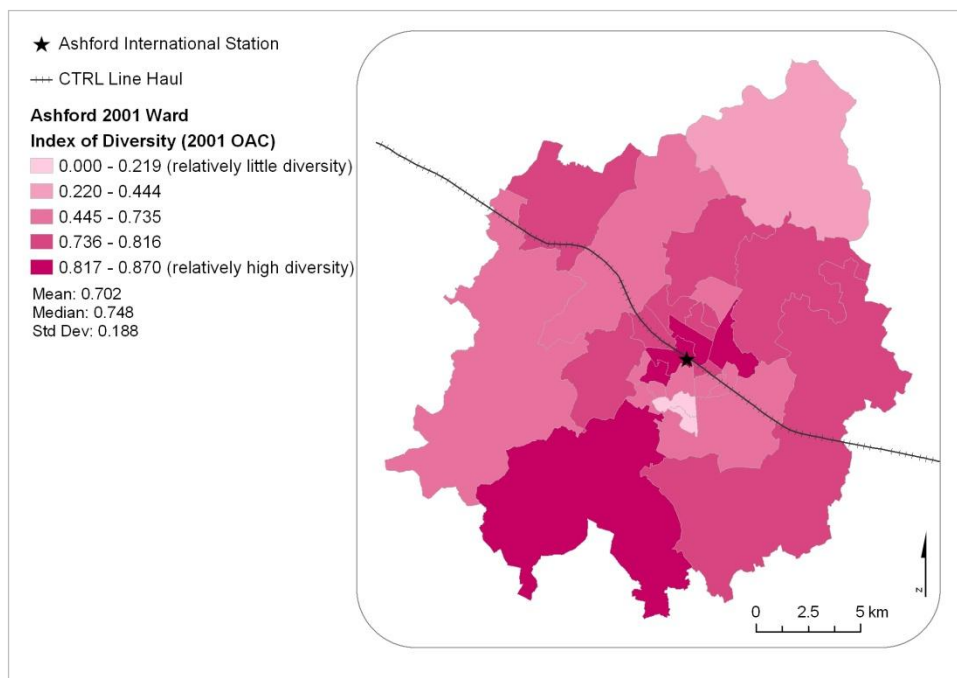


Fig. 7.14: Ashford Index of Diversity at 2001 ward level: 2001 OAC [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

The diversity index for this 3km zone is $1-D = 0.915$ (calculations are within appendix 10.3), a very high value indicating that Ashford is very socio-economically diverse. The mean intra-ward level diversity for Ashford is lower in the wider 10km analysis zone ($1-D = 0.702$), as illustrated by fig 7.14 above, with one ward only containing a single OAC group, Prospering Younger Families and therefore returning an index value of zero (and therefore any 2 random people chosen from this ward have a theoretically zero chance of being from different OAC demographic group). Inner Ashford is more diverse, yet the ward with the highest diversity is to the south, where the suburban and rural fringe meet, containing a range of OAC groups ranging from Prospering Older Families, to Older Blue Collar Worker to Village Life.

Ebbsfleet

Ebbsfleet comprises 17 OAC groups, covering 121 OAs in the 3km analysis zone, although the area is less than half that of the Ashford 3km zone since it is truncated by the Thames. The Index of Diversity mean is $1-D = 0.892$, slightly less than Ashford (calculations in appendix 10.4). Here the largest proportion of OAs are in 6c 'Young Families in Terraced Homes'; nearly a fifth of all OAs are in this group. The new Ebbsfleet Valley development is classed as 'Aspiring Households'; a group making up 5% (6 OAs) of the total, and therefore one of the smaller demographic classes in the analysis zone (although there are 6 further classes between 1-3% of the population each).

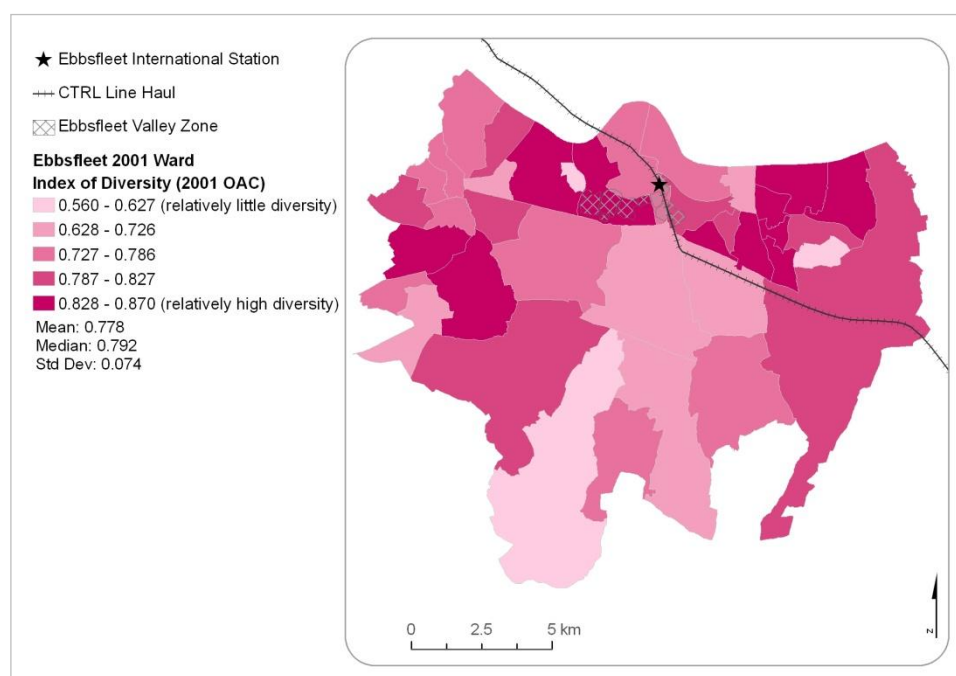


Fig. 7.15: Ebbsfleet Index of Diversity at 2001 ward level: 2001 OAC [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright and database right 2003; Contains Ordnance Survey data Crown copyright and database right 2003]

At ward level, Ebbsfleet has, as expected within the wider 10km analysis zone, the highest demographic diversity where the urban and suburban areas meet (fig. 7.15 mean diversity index of 0.778). Yet the small wards at the centre of Dartford to the west and Gravesend to the east are the least diverse, and the peripheral wards, which are largely rural, are generally mid-level diversity. The proposed development falls within an area that is already highly diverse; the new influx of the expected demographic (Aspiring Households) in contrast to the more 'working class' population already in residence.

7.1c

The Demographic Profiles indicator:

Findings and critical assessment

The indicator aim

The aim of this indicator was for planners to be able to ascertain if the potential level of changing demographics brought about by a relatively rapid influx of a new population attracted to the hub due to the MUDP and/or its associated developments could lead to an alteration in former community structures. This could lead to an increased risk of low community cohesion.

The indicator findings

With a single release of the Output Area Classification (OAC) from the 2001 census, no suitable comparative dataset is available with which to consider the changes in demographic profile at the hubs over time as yet. Moreover with the delay in constructing the Ebbsfleet Valley homes, no significant change in population related to the MUDP (in theory) has taken place in Ebbsfleet. However, high population turnover noted in some parts of Ebbsfleet (in the Meta Themes score chapter 8 below) suggests that there are reasons not clearly associated with the MUDP that are causing significant numbers (e.g. over 1.5 standard deviations from the Kent mean for one Gravesend ward) to move in and out of the case study hubs. Furthermore, considering the Ashford masterplan to 2035 and its status as a government designated Sustainable Communities Growth Area, and Ebbsfleet's central position within the Thames Gateway regeneration area, there will be a new influx of population not directly related to the MUDP. The fast travel time to London on the CTRL domestic service will no doubt be an influencing factor that attracts people to the new homes in both hubs, but to what extent can this be considered a second-order impact? It would be right to assume that if the CTRL service is mentioned in the promotional literature for the new homes, that it is considered of added value to the area. Subsequent analysis of the workplace flows of the new population would establish the level of usage, but no doubt many other factors contribute to the inflow migration of people to an area around an MUDP of which the importance of the transport infrastructure is variable at household if not individual level.

Considering the aim of the indicator from a hypothetical perspective, the indicator for assessing demographic diversity is useful as an aid in assessing where populations of different socio-economic status are in relatively close proximity. In Ebbsfleet, the proposed new population has been assigned to the OAC group 'Aspiring Households'. It is apparent that this new community would be mostly spatially segregated by either transport

infrastructure extent, such as the dual carriageway, car parking for the CTRL station and Bluewater shopping centre, or the CTRL line haul, as well as the topography of former chalk and clay quarries. The indicator maps also highlighted where the new development was in close proximity to existing communities and this could be a source of inter-community tension. Whilst this would have been clear to the planners and developers when they designed the urban space for approval, the plans for the Springhead Park tend to be presented to the public with a finite space around the border of the development as the limit of the illustrative material (see fig. 7.16 below), and the interface between new and existing communities absent or in the background. Does this reflect the stakeholders and/or planners perception of the new build? One assumes not, but do existing local residents feel that they have little control over changes in their immediate public space? How much does the inter-community interface register in any prospective new occupiers of Springhead Park? Should it?



Fig. 7.16: The extent of the Springhead Park masterplan (© Countryside Properties April 2008)

Critique of the indicator method

Experimenting with scale would alter the output, and local knowledge by the planners of approximate extents of 'neighbourhoods' would enable this indicator to produce an Index of Diversity that more closely resembles the perceptions of the residents. For example, the OAC has a hierarchy of classification from SuperGroup, Group and Subgroup. In reality it is more than likely that populations that typify Aspiring Households and Settled in the City do not feel or appear to be so different from each other, similarly for Younger Blue Collar and Young Families in Terraced Houses, for example. Therefore to consider an area where

these OAC groups are alongside each other and are considered 'diverse' is possibly creating a false dichotomy, where ambiguity is almost sure to exist. Aggregating the classification to SuperGroup level and looking at ward-level diversity may be a truer reflection. Exploring and defining context-specific 'main' population groups that exist within a hub under study (such as retired or student, Afro-Caribbean or a generic 'lower socio-economic class' typology for example) may be more instructive for considering the demographic diversity in terms of reducing the risk of low community cohesion with a change in demographic profile following the delivery of the MUDP.

The use of ward boundary definitions is problematic, with different levels of population in each (see chapter 5 for population density differences), and the Index of Diversity is by its very essence, scale sensitive. The effects of ward population scale were seen by the dominance of Castle ward in the Ebbsfleet 3km zone in the Combined Score (chapter 8.1 below), almost certainly due to its uncommonly small size, which is not resolved by normalising the datasets. Context-specific spatial boundaries defined by local planners, by 'heads-up'/on-screen digitising within a GIS environment is straightforward and certainly adds greater strength to the output, with more relevance to the processes occurring during and post-MUDP delivery. Without this, the aim of the indicator is only partially achieved. Demographic groups may also attract new residents of a similar demographic that could impact upon the diversity of a community not related directly to the MUDP but not controlled for here.

Future guidelines for planners and decision-makers

Once viable and context meaningful definitions of both spatial units and classification are designated, planners and decision-makers will have a deeper appreciation of the pre-existing demographic types and their spatial configuration in relation to MUDP-related planned development. Creating new homes and jobs is often part of an MUDP's regeneration plans, and integration between old and new residents requires respect and an enhancement of differences to emphasise the important contribution each demographic makes to the local community (Ngau, P. personal communication Nairobi 2010).

Lessons learnt for planners and decision-makers

If this indicator assessment was repeated as and when the new development was constructed, the changes in the hubs demographic profile would be revealed. However, the 'complex' nature of the changing profile of a population means that the lessons-learnt will be context-specific to each hub, and not applicable to a large extent to other MUDP hubs. However both hubs confirmed that at ward level that the greatest diversity occurred at the urban/rural fringes, where the new residential developments are planned, hence there is a potential risk for wider community disharmony. With reference to the *Cynefin* framework, impacts that seem to fall within the 'complex' domain are unpredictable in the specific details

regarding the nature of the impact. The decision-making model suggests 'probe-sense-response' for managing complex processes. This entails devising amplifying strategies for positive aspects of the changes to the demographic profiles and dampening the negative. As with all complex processes, there is the potential for a small change (such as amplifying or dampening initiatives) in one area to have significant repercussions in the community that will be impossible to prepare for in advance.

7.2a

The Socio-economic Deprivation indicator:

Methodology

MUTPs can act as catalysts for regional and local redevelopment which bring with it changes to the community structure, physically, economically and socio-demographically, potentially resulting in long-term benefits to the existing surrounding community. This indicator explores the changes in relative levels of deprivation in the communities around the station, but clearly an area may become more or less deprived as a result of many interventions although attributing a level of change to an MUTP cannot be precise. However a link between the CTRL project and changes in deprivation is considered likely (Kent Thameside 2007). Deprivation indices are useful nonetheless as secondary background data for other impact indicators including changes in relative accessibility, spatial confinement, affordability and social exclusion. Ebbsfleet, the main case study, is in an area of high deprivation since the depletion of local blue-collar industries brought about a state of continued economic decline. The CTRL is a major catalyst in the regeneration of the Kent Thameside, hence improvements in deprivation in the Ebbsfleet area are hoped for. In comparison, Ashford is relatively wealthier, and although it is an Opportunity Growth Area, it will not see the scale of change planned for around Ebbsfleet. Nonetheless the CTRL may have influenced changes around the station in the centre of the urban area that has decreased relative deprivation.

Potential benefits for the MUTP appraisal

A significant benefit potentially arising from the implementation and delivery of the MUTP could be the reduction of multiple dimensions of deprivation through local and regional investment at the MUTP hub, and associated urban regeneration projects.

The aim of the indicator

The aim of the Deprivation indicator is for planners to be able to explore the potential impact that the MUTP may have had on decreasing levels of relative deprivation in areas around the hub, over a larger surrounding area. This suggests that the delivery of the MUTP can bring socio-economic regenerative effects to a deprived area, and that this relationship is positive

Objectives

- To extract a CTRL hub subset of the Index of Multiple Deprivation and one sub-domain (Geographical Barriers) at two different periods to form the main data to consider the changes of deprivation before and at the time the CTRL domestic service commences. These will be generated for both Ashford and Ebbsfleet, with a wider geographical context, the SE England GOR, provided within the appendix (10.5)

- To create 'box plots' and composite bar charts to clarify the patterns seen between different time periods. Box plots (sometimes called box-and-whisker plots) illustrate the median value in a range with the 'box' identifying the upper quartile (75%) and lower quartile (25%) of all the values. The 'whisker' lines illustrate the range of values between 1% and 25%, and 75% and 100%, thereby offering an indication of skewness and dispersal of data values.

Method

Deprivation can be considered a "latent variable" or "latent construct" as it is not directly observable. It is an abstract psychological concept that can only be inferred from other measurable variables, and in this sense is a derived variable. This informs how deprivation indices have been constructed in the past and present, which are context specific (in terms of their input variables) for their time. Fundamentally though, deprivation can be considered where people are lacking access to a resource that can be considered important to attain a basic standard of living, with the prevailing view that restriction to these resources affects people to differing extents. Nonetheless deprivation metrics help local and national governments plan better allocations of resources for those most in need. In the 19th century deprivation mapping was carried out by Charles Booth, Joseph Rowntree and subsequently his son Seebohm. A range of spatially-linked measures have been produced during the 20th century to guide policy makers, including the Carstairs Score from the 1981 census (Carstairs and Morris 1989:11), the Townsend Index compiled in 1988 (Townsend et al. 1986), the Jarman Underprivileged Area Score during the 1980s and the Index of Local Conditions from the 1991 census (Department for the Environment, Transport and Regions).

The index employed in the impact indicator for the case study hubs is the Index of Multiple Deprivation (IMD), released in 2000 at ward level, then in 2004 and 2007 at Lower Super Output Area (LSOA). The latter have the advantage of containing a more homogenous socio-economic population (c1500 households) than the on-average larger ward populations (Morgan and Baker 2006:29). These indices are calculated on a shorter cycle than the 10-year census, and cover a broader spectrum of socio-economic areas that contribute to deprivation, i.e. housing, crime and education (Morgan and Baker 2006:29). The IMD has seven weighted domains, six sub-domains and 36 indicators making up the multifaceted index (Caulder et al. 2009), with 'Geographical Barriers', a sub-domain of 'Barriers to Housing and Services' outlined in red in fig. 7.17 below. This relatively small sub-domain (c4.65% of the measure) is included separately as a sub-indicator and comprises four variables:

In the IMD 2004 Geographical Barriers domain, the variables measure the population-weighted average road distance (in km) to

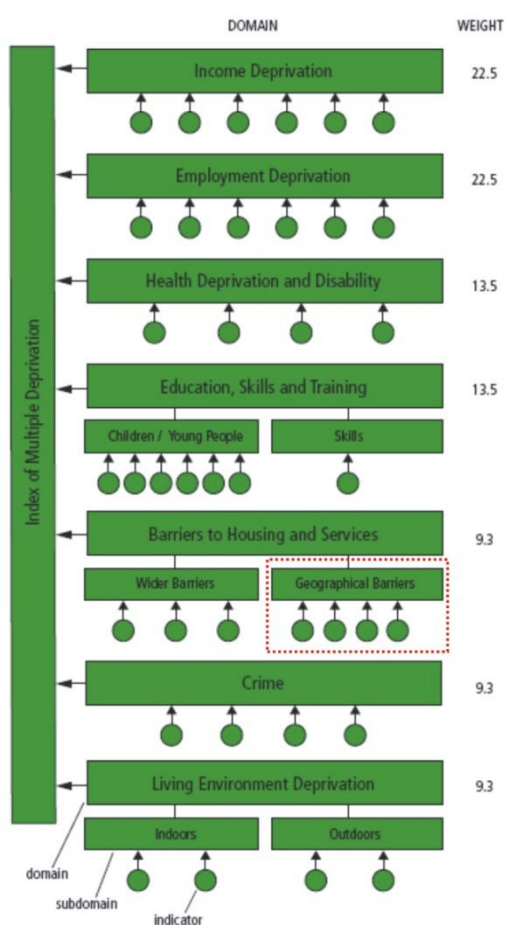
- a GP surgery (Source: National Health Service Information Authority, 2003)

- a general store or supermarket (Source: copyright © Pitney Bowes MapInfo Ltd, 2002)
- a primary school (Source: DfES, 2001–02)
- a Post Office or sub post office (Source: Post Office Ltd, 2003)

In the IMD 2007 Geographical Barriers domain, the variables measure the population-weighted average road distance (in km) to

- a GP surgery (Source: National Health Service Information Authority, 2005)
- a general store or supermarket (Source: copyright © Pitney Bowes MapInfo Ltd, 2005)
- a primary school (Source: DfES, 2004–05)
- a Post Office or sub post office (Source: Post Office Ltd, 2005)

Fig. 7.17 (left): Domains and sub-domains in the Index of Multiple Deprivation (D.G.L.C. 2007a)



The Geographical Barrier sub-indicator produces a very different dispersal of values to the combined IMD picture, as urbanised areas in this domain are often ranked relatively higher although by no means consistently, above more rural areas. It has been included as a basic but 'blanket' accessibility measure to essential facilities over the whole 10km analysis zone area (cf. the Accessibility measure in section 7.3 of two feeder bus routes).

Issues to consider when utilising the IMD datasets

Deprivation is a phenomenon that can be attributed at several scales from the individual to a neighbourhood or institution, or a sub-class of the population such as the elderly. This acknowledgment leads to the technical question of how to measure deprivation in terms of at

what spatial scale it is relevant. There are of course limitations set by the resolution of released output data from compilers such as local government or the census. It is clear therefore that very little can be understood from these measures of individual experience of multiple deprivation dimensions, but nonetheless, restriction to a range of resources will give a picture of the different facets of deprivation faced in an area relative to other areas (Noble et al. 2008:10).

There are many pitfalls to circumnavigate when choosing indices particularly in association with combined or composite measures. While a composite index can be useful as it encapsulates several aspects of deprivation, there can be logistical and theoretical issues beneath the surface that should be understood before adoption of a measure. For example, it is common practice to standardise units of measures which removes the element of hidden weighting, or having to construct a weighting scheme, but it is debatable whether this is desirable (Senior 2002:129). There are several reasons why one could choose to transform deprivation variables; to reduce the effect of an over-dominating indicator (Thunhurst 1985:95), and/or to convert the distribution to a normal dispersal of values (although others have countered that this is only necessary for some statistical analyses such as PCA or Factor Analysis). Not doing so could introduce a heightened risk of double counting where there are highly correlated variables (Carr-Hill and Sheldon 1991:702). Finally transformations can help re-address any problems of indices cancelling each other out, and the IMD 2004 and 2007 are founded upon a weighted cumulative model which leads to limited cancellation effects (Noble et al. 2008:11). When dealing with composite multiple domain indices, there is the question of weighting variables. Three main methods are utilised as there is often very little opportunity to weight domains based on empirically-backed values/reasons due to the cost of researching the real impact, hence they are more often either equally weighted or arbitrarily differentially weighted. Ranking issues known in the first IMD2000 include their symmetrical nature and equidistant indicator values that can erroneously cancel each other out. This was calibrated by the transformation of the rank value to an exponential measure that accentuates the 'tail' of the most deprived areas (Senior 2002:130-31).

Future guidelines for planners and decision-makers

In the example presented below, there is a comparison between the rankings of LSOAs in the hubs between 2004 and 2007, which is a short time-span for identifying significant changes, and any changes following the implementation of the MUDP could take decades. Therefore the following sub-indicators (the composite measure and the Geographical Barriers measure) are 'worked examples' intended to demonstrate how such a method could help planners monitor and plan for deprivation reduction.

This indicator could highlight the location of local areas that can be considered to be at risk of spatially entrenched deprivation, and that could benefit from MUDP-related intervention, such as improved accessibility, increasing the mix of housing tenure, improved 'walkability' or permeability.

Lessons Learnt for planners & decision-makers

Changes in relative deprivation can be considered as a 'knowable' process, whereby the causes that change deprivation may become clearer over (possibly a long) time, although

the relationship is complicated. One can however generate 'good practice' guidelines from experience to aid decision makers to 'Sense' (with deprivation indices for example), 'Analyse' (the creation of GIS-based indicator), and 'Respond' (what MUTP-related interventions are deemed appropriate and anticipated to be the most beneficial). Comparison between the hubs provides the chance to consider the patterns of change to be context specific, or have an underlying generic relationship.

Cross-influence with meta themes

A sub-domain of the IMD, the Income domain (which accounts for 22.5% of the IMD), is also an input variable in the Social Exclusion indicator (in chapter 8.2) to provide a general picture of the dispersal of income-related poverty. By not including the entire IMD when exploring social exclusion, this avoids the double counting with supplementary employment datasets.

7.2b

The Socio-economic Deprivation indicator:

Input data and output maps

The base dataset for this measure is the Index of Multiple Deprivation 2004 (IMD04) and 2007 (IMD07) published by the Department for Communities And Local Government at Lower Super Output Area level, clipped to the LSOAs surrounding the CTRL stations at Ebbsfleet and Ashford within the 10km 'wider context' analysis zone. The SE England Government Office Region (GOR) is adopted as a regional context and is located within the appendix 10.5. It is anticipated that the maps demonstrate the changing levels of deprivation around the hubs. Also this indicator illustrates a potential methodology for understanding where and how much deprivation (relative and absolute) exists in the case study areas before and after MUTP delivery.

The two variables are the combined Index of Multiple Deprivation (IMD), and the Geographical Barriers sub-domain (distances from a range of key local services). The entire dataset of LSOAs in England ($n = 32,482$) were ranked, 1 being the most deprived, from which the sub-datasets were extracted for Ashford, Ebbsfleet and SE England GOR. It is evident that when one employs a ranking metric what the visual outputs demonstrate is the *relative* deprivation of an LSOA over others under analysis, without explicit reference to precisely the deprived nature of that LSOA. In order to provide sufficient information that can be used to respond to the relevant research questions, box-and-whisker plots and bar charts further clarify the spatial patterning in the maps. This section initially assesses the IMD 2004 and 2007 in Ashford, then Ebbsfleet and closes with a combined descriptive bar chart that compares the absolute deprivation ranking deciles, and changes in rankings of relative deprivation in quintiles for Ashford and Ebbsfleet compared to SE England.

The GIS map outputs are the 10km analysis zones of the two hubs, with the 'decile classification' bands fixed at 1/10 of the ranking range (for the whole country). Some of the analysis areas do not have the most deprived class, hence the map only illustrates the subsequent nine classes. All the colour ramps and value bands in this indicator are identical to facilitate ease of comparison between areas and time periods. A miniature vertical bar chart accompanies each mapset with the percentage of LSOAs per decile class in order to quickly assimilate the dispersion. The red vertical dashed line on these bar charts indicates where the class becomes progressively more deprived (to the left) or less deprived (to the right). These bar charts are the basis for the comparison chart at the close of the section and will be examined in greater detail and clarity.

The Ashford Indices of Multiple Deprivation

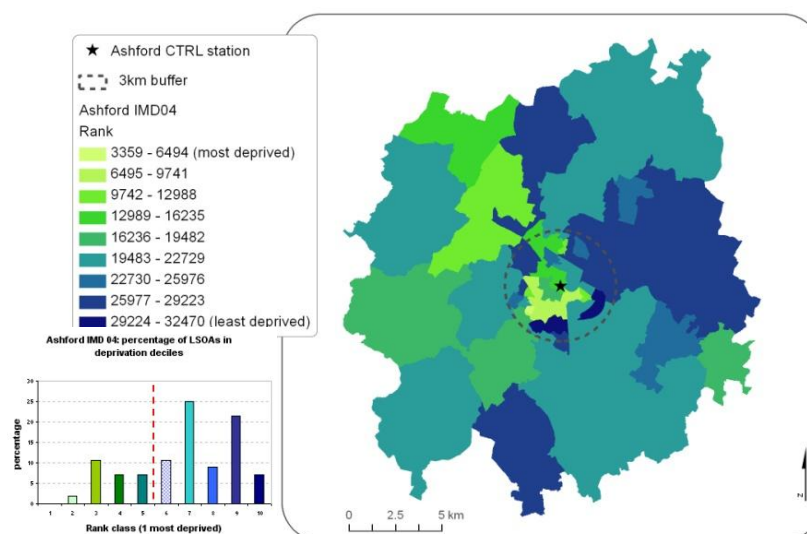


Fig. 7.18: Ashford 10km analysis zone: IMD 2004 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

Ashford displays a small concentration of combined deprivation LSOAs in the heart of the analysis zone (fig. 7.18 above), around the station but the surrounding urban/rural fringe areas are by no means all characterised by low relative deprivation. To the north-west, some LSOAs are in the upper deciles (fixed 10ths of the total English rank values), indicating that some deprivation is occurring for the population in much lower density areas.

In 2007 (see fig. 7.19 below), the level of deprivation rises in most areas both in the centre of the urban region, and similarly in the urban/rural fringe. The area of lowest relative deprivation remains to the east of the urban core.

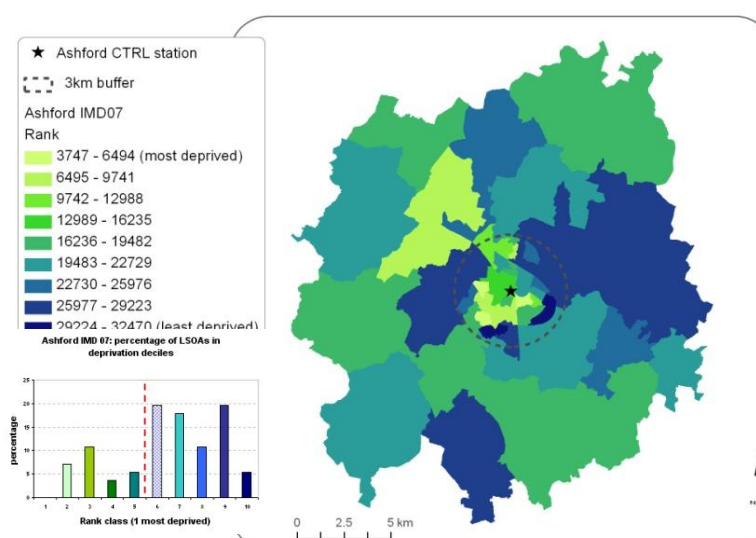


Fig. 7.19: Ashford 10km analysis zone: IMD 2007 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

In order to consider the relative change between the two temporal snapshots of these indices, maps were produced that explored which LSOAs rose or fell in relative ranking order. The quintiles used in the rank-change maps have been manually classed by initially dividing the normally distributed range into equal quintiles (with the same range of values in each) and ensuring that the median of the middle (third) quintile was zero (illustrated by the central quintile in fig. 7.20 below). The remaining classes were evenly distributed with the 1st quintile of greatest declining rank order outliers (in dark red), the 2nd quintile of moderate declining rank order (mid-red), the aforementioned 3rd quintile being that of relatively little, to no change in rank order, the 4th quintile of modest improvement in ranking (mid blue) and the final quintile of greatest ranking improvement (dark blue). The maximum positive and minimum negative values of the 1st and 5th quintiles obviously are not evenly located either side of zero as there are some significant outliers in some of the datasets, but overall this was found to be the most satisfactory classification to illustrate visually the changes in relative deprivation between 2004 and 2007. In later discussions “fallen in rankings” refers to those LSOAs that fall into the first and second quintiles, “minimal change” is the central quintile that reflects that relative ranking changes occur as other LSOAs fluctuate up or down around them. “Rise in rankings” therefore refers to LSOAs in the latter two quintiles (4th and 5th) of improvement. Of course this is a very short time-period, but the changes serve to provide a basis for discussing the hypothetical approach to MUTP-related social policy relating to deprivation.

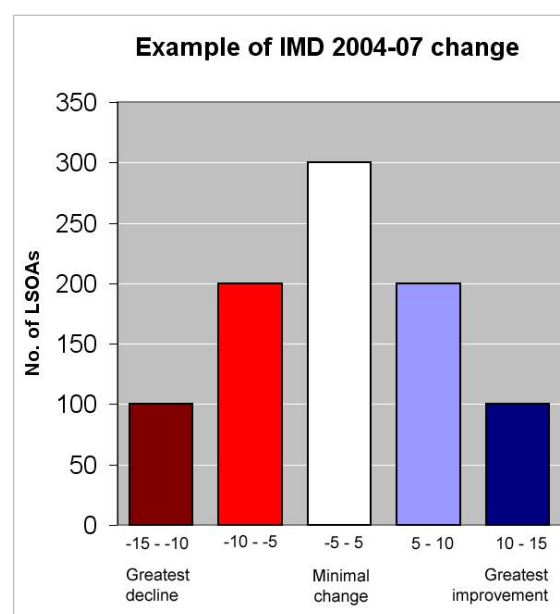


Fig 7.20: example of rank changes classification

However, some caveats that are worth mentioning include the observation that a change of rank does not necessarily imply that there have been any changes in that LSOA, only that *relative* to other LSOAs, it has changed rank order. Therefore if LSOAs in a completely

unrelated area improve and the LSOAs under study have no change, then they will, along with others, fall in rank order. The reverse is true if unrelated LSOAs suffer an increase in deprivation. Then the LSOAs in the study sample could rise in rank order without undertaking any socio-economic efforts to improve. Another facet to this, the fall or rise in rank order does not alone give an indication of the level of deprivation in an LSOA; a rise, even a significant one, may still not be sufficient to pull an LSOA out of a low ranking place, and similarly a fall in order may still leave a LSOA in a place of relatively low deprivation.

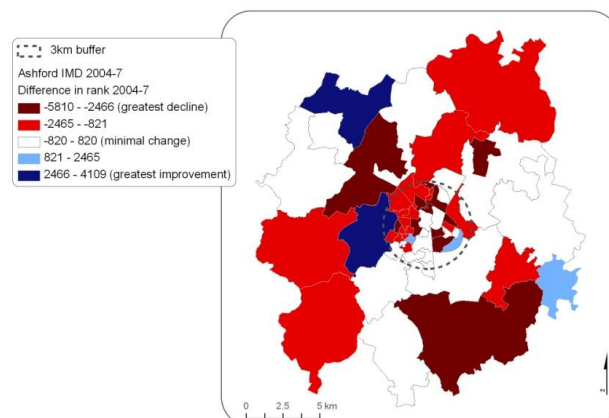


Fig. 7.21: Ashford 10km analysis zone: IMD changes in ranking 2004-7 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

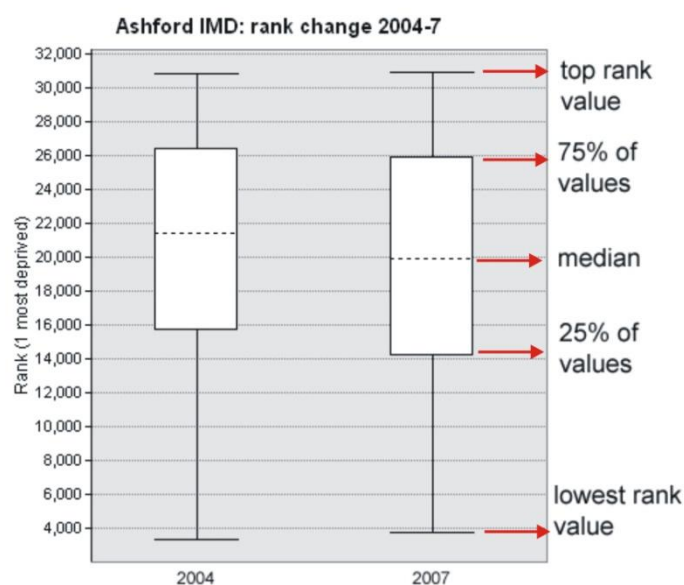


Fig. 7.22: Box plot: Ashford IMD changes in ranking 2004-7 (comparative ranking dispersal)

The rank change map (fig. 7.21) is largely coloured red, as the LSOAs which fell in rank order are generally larger and less densely populated, and those LSOAs which saw the greatest decrease in rank are not located preferentially closer or further away from the urban core, but spread across the analysis zone on a broadly SW-NE axis with further decreases to the south-east. Despite the initial impression that Ashford is sliding into relatively high

deprivation, the box-plot (above fig. 7.22) demonstrates that the analysis zone on the whole ranks high, with the median of 2004 IMD at 21,423rd and the bottom value of the inter-quartile range almost in the upper half of the data range; hence nearly 75% of the LSOAs are in the lower relatively deprived ranks (i.e. below the English national average). In 2007 however, the Ashford analysis zone experiences a drop in the rankings with the median falling to 19,940th and the inter-quartile range expanding into the lower half of the values. Some good news for Ashford in the 2007 index is the most deprived LSOAs rose in rankings from 3,359th to 3,747th, both of which are considerably higher than Ebbsfleet's lowest 2007 value of 1,875th in rank order.

Ashford Geographical Barriers

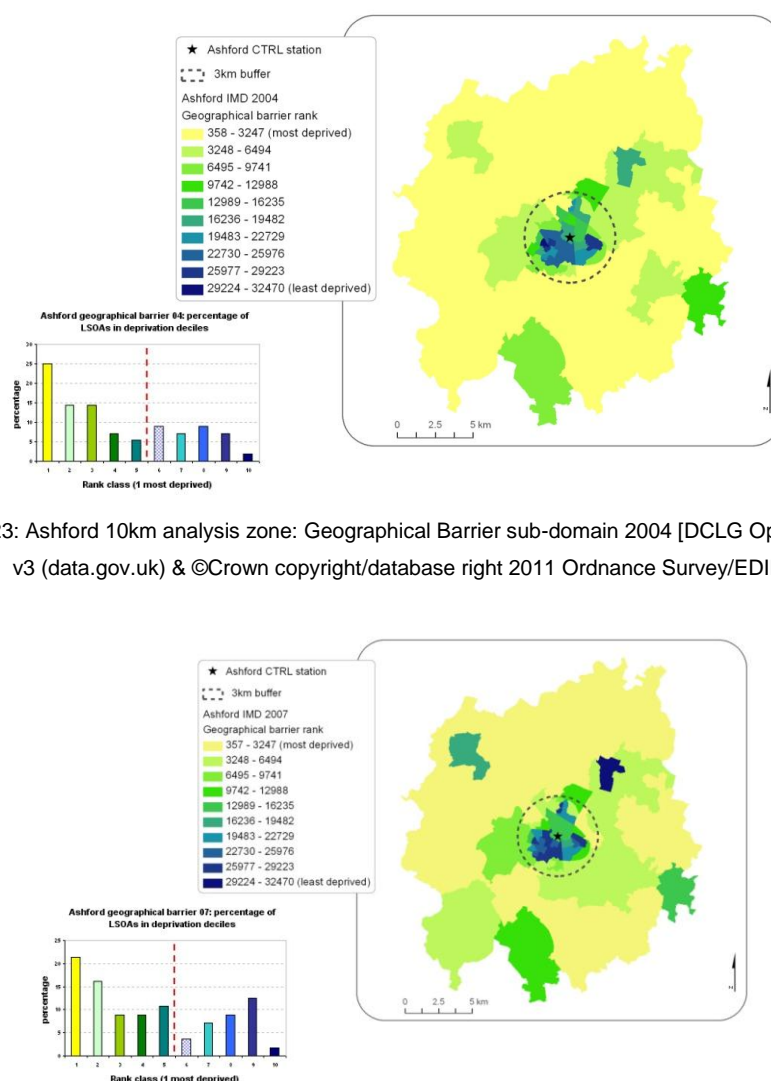


Fig. 7.23: Ashford 10km analysis zone: Geographical Barrier sub-domain 2004 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

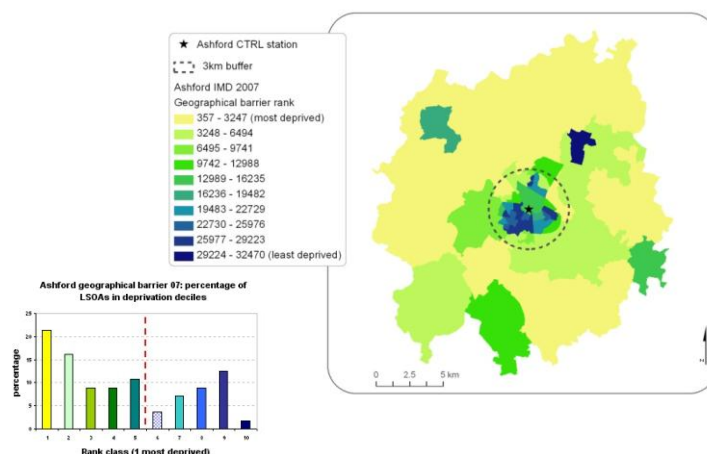


Fig. 7.24 Ashford 10km analysis zone: Geographical Barrier sub-domain 2007 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

For the Geographical Barriers sub-domain measures, Ashford has a small number of highly accessible LSOAs located in the centre of the densely populated area in the centre and

pockets north-east and north-west (fig. 7.23 and 7.24). The remainder are moderate to relatively highly deprived (low accessibility) with the minimum ranking for 2004 the 358th and 2007 the 357th. Between 20% and 25% of LSOAs are in the lowest ranking decile for both periods of data capture.

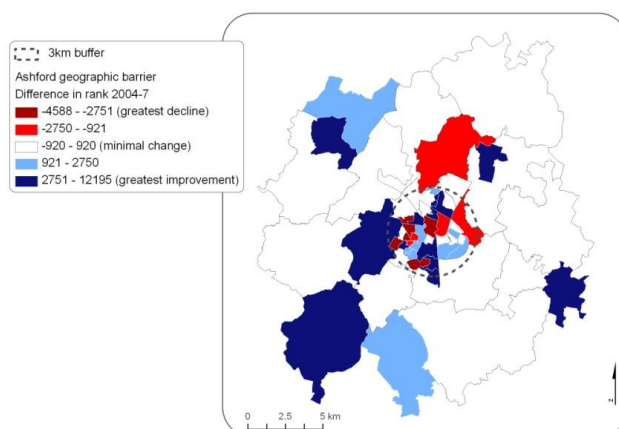


Fig. 7.25: Ashford 10km analysis zone: Geographical Barrier sub-domain changes in ranking 2004-7 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The extent of change between 2004 and 2007 for the Geographical Barriers measure is much less dramatic than the rank change for the combined IMD above, with many of the LSOAs falling to the central 3rd quintile of relatively minimal rank order change. Some inner-urban and urban/fringe areas decrease but the rank improvements occur all over the analysis zone (fig. 7.25 above), with one LSOA as much as +12,195 in rank places located north-east of the main urban core. The box plot (fig. 7.26) below however, suggests that the Ashford analysis zone suffers from relatively poor access to key resources, with the values of the 2004 upper-quartile range reaching a mere 19,105 and the median registering a lowly 8,947th, indicating that this is not normally distributed but skewed towards the lower rankings. In 2007 the rankings improve with the median rising to 10,130th and the inter-quartile range expanding to absorb less deprived LSOAs. The least deprived LSOA fell though from 30,820th to 29,648th.

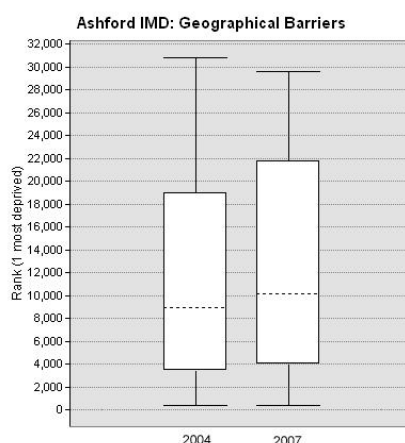


Fig. 7.26: Box plot: Ashford Geographical Barrier sub-domain changes in ranking 2004-7

'Entrenched' deprivation in Ashford

As Ashford is a comparatively wealthy area, only ten LSOAs of 56 in the 10km zone fall into the lowest deprivation decile class. They are all located within the central 3km analysis zone (see fig. 7.27 below), predominately south of the station. The bar chart (fig. 7.28) confirms that two thirds of these LSOAs have fallen in rankings between 2004 and 2007, one third by over 2000 rank places. These 'most deprived' and 'not improving' areas are considered as experiencing relatively 'entrenched' deprivation for the purposes of this study, and are revisited in later indicators of the MUP impacts. The LSOA with the largest rank change is an area (highlighted with a yellow outline in fig. 7.27 below) located close to the station where the line haul dissects it. The only LSOA to improve (in mid-blue) is located amongst others that fell in rankings, but away from the line haul. Is the CTRL playing a role, via the impact of the physical infrastructure?

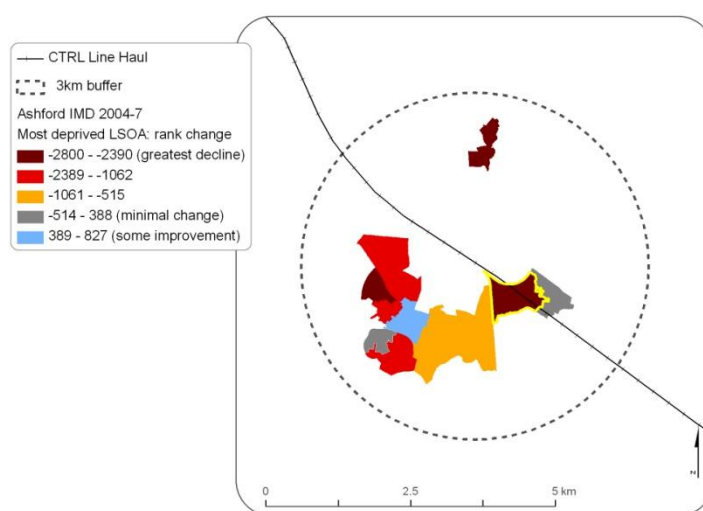


Fig. 7.27: Ashford most deprived (IMD) LSOA rank changes 2004-07 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

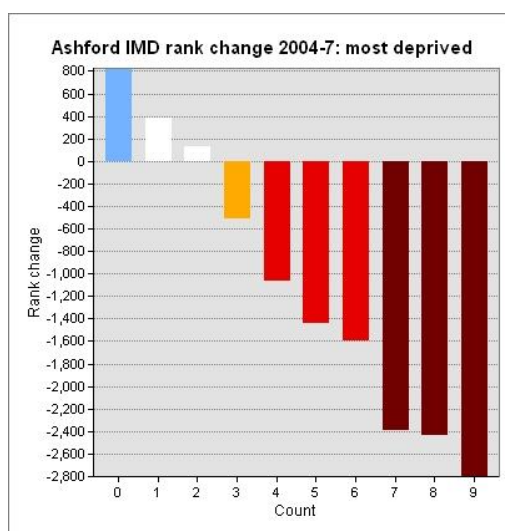


Fig. 7.28: Bar chart for the change in rankings for most deprived (IMD) LSOAs in Ashford

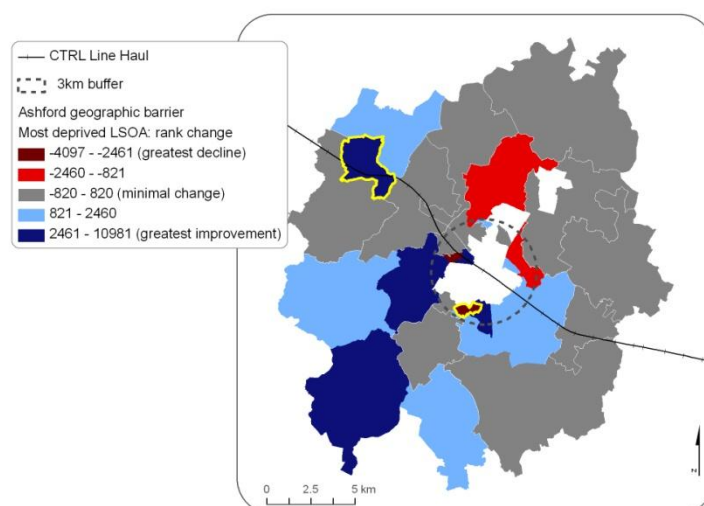


Fig. 7.29: Ashford most deprived (Geographical Barriers): rank changes 2004-07 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

In contrast to the general IMD rankings, 54% of the LSOAs in Ashford are in the lowest deprived decile for the Geographical Barriers measure. Generally located around the periphery of the urban core of Ashford (fig. 7.29), those of greatest decline are on the border of the 3km zone, whilst the greatest relative improvements are on the outskirts, in the more rural areas. The bar chart (fig. 7.30) clarifies that nearly half of the LSOAs improve in ranking with only four falling, and the area with the largest fall is located to the south on the urban/rural fringe (a red polygon with a yellow outline in fig. 7.29 above). The LSOA with the largest rank change for this domain is an improvement of +10,981, and is located in the far north-west (a blue polygon with a yellow outline in fig. 7.29 above). The CTRL line haul runs also directly through it, thereby suggesting that proximity to the line haul either has no impact or a complex indirect effect on the deprivation of an area.

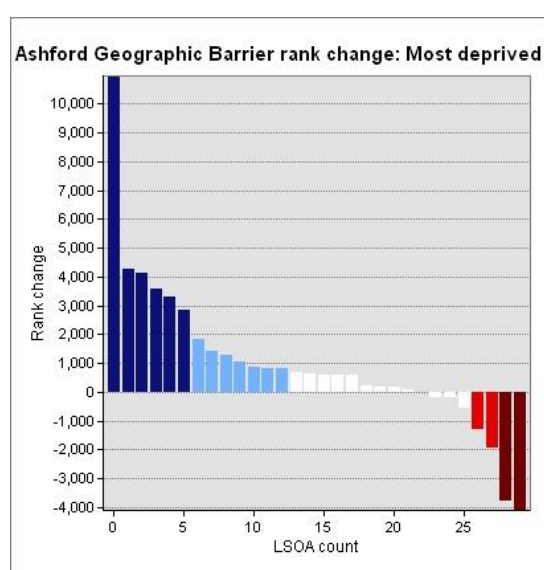


Fig. 7.30: Bar chart for the change in rankings for most deprived (Geographical Barriers) LSOAs in Ashford

The Ebbsfleet Indices of Multiple Deprivation

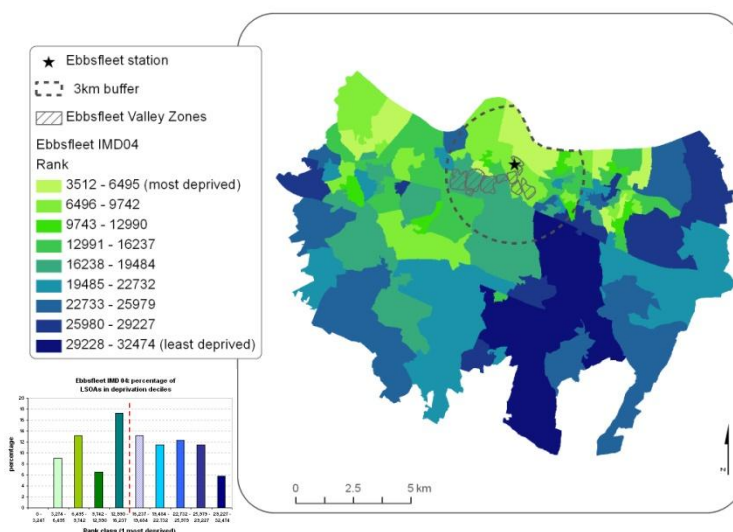


Fig. 7.31: Ebbsfleet 10km analysis zone: IMD 2004 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The deciles (fixed 10ths of the total English rank value) demonstrate that there is a swathe of zones most relatively deprived along the Thames, that is the Kent Thameside area (fig. 7.31). LSOAs ranking in the central values to the west (London's urban / rural fringe) and the least deprived LSOAs located to the east. It is pertinent to remember though that spatial patterning can be misleading due to the uneven sizes of LSOAs, as they encompass roughly 1,500 households of approximately similar demographics. Hence the lower density in more rural areas gives the impression that a larger proportion of the analysis zone is relatively less deprived than is the case. The small-scale vertical bar chart confirms that the first and second-most prevalent decile are the 5th and 3rd respectively, both of which are in the more deprived half of the rank values.

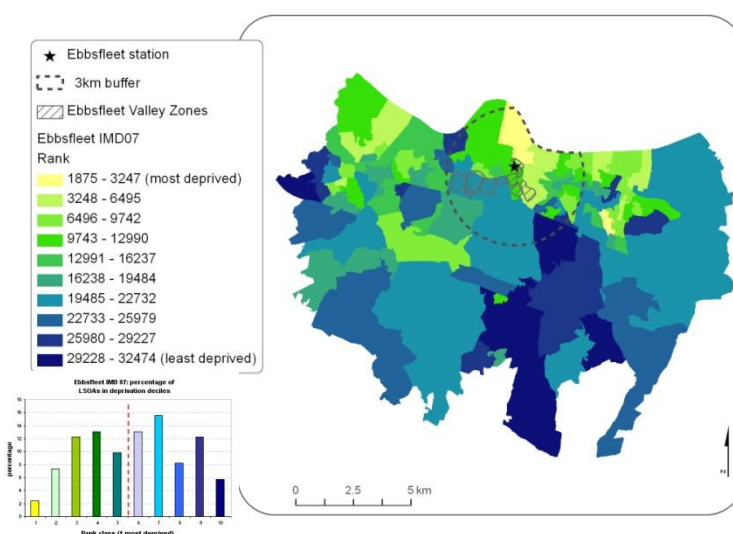


Fig. 7.32: Ebbsfleet 10km analysis zone: IMD 2007 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The pattern for the 2007 index remains broadly the same (fig. 7.32 above). Of note, the proposed Ebbsfleet Valley redevelopment zone is hypothetically classed as being of middle ranking deprivation, and one LSOA nearby falls into the lowest decile (a class which was absent in the previous map 7.31). The LSOAs populate the 'less deprived' ranks to a greater extent than 2004, illustrated by the mini bar charts in figs. 7.31 and 7.32.

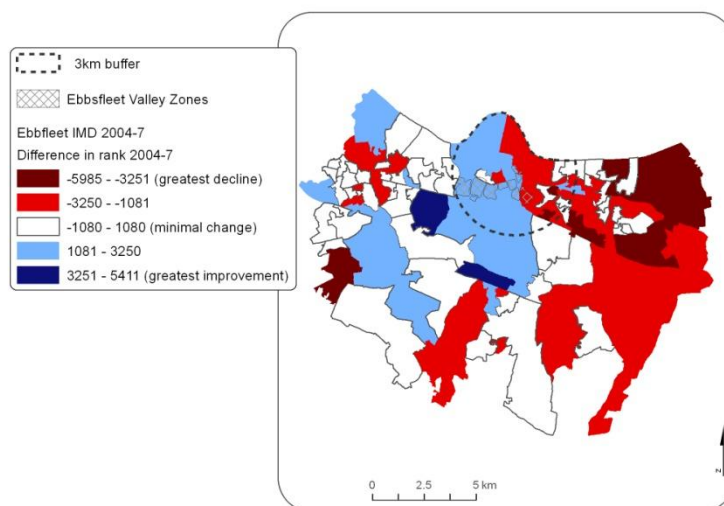


Fig. 7.33: Ebbsfleet 10km analysis zone: changes in relative ranking 2004-07 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The change in ranking map (fig. 7.33), indicating where and which LSOAs have changed in rank, illustrates that the rises in deprivation ranking is broadly limited to the western side of the analysis zone, including areas around the planned Ebbsfleet Valley redevelopment. The LSOAs of greatest decline in relative rank order are mostly located in and around Dartford in the north-west.

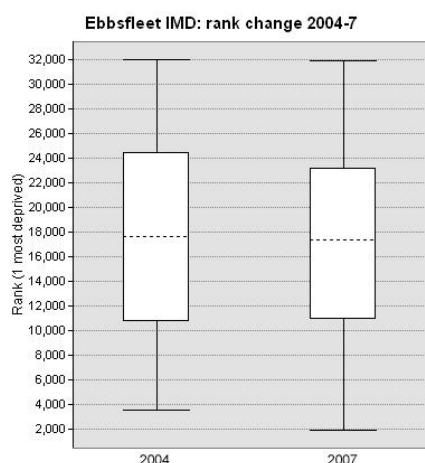


Fig. 7.34: Box plot for Ebbsfleet IMD ranks 2004-7

The box plot for the ranking change between 2004 and 2007 (fig. 7.34 above) demonstrates that their median rank order for both years is very similar; both are above the median value for England of 16,241, with the median for 2004 at 17,635 and for 2007 at 17,366. Hence for both years over half of the LSOAs are relatively less deprived in the combined measure.

However the most deprived of the LSOAs are relatively more deprived in 2007 with the maximum negative value falling from rank 3512 to 1875. Also the inter-quartile range is smaller for 2007 but both are relatively normally distributed.

Ebbsfleet Geographical Barriers

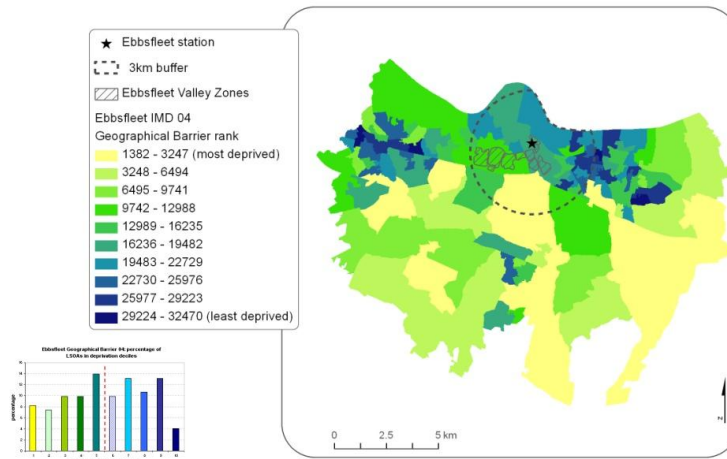


Fig. 7.35: Ebbsfleet 10 km analysis zone: Geographical Barrier sub-domain 2004 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The above map (fig. 7.35) instead shows the pattern of relative deprivation with regards to the Geographical Barriers measure such as road distance to GP surgery, shops, schools and Post Office. It demonstrates that as expected the areas of greater urban density, Dartford to the north-west, and Gravesend to the north-east of the analysis zone, have better accessibility to these key resources than areas further out in rural Kent.

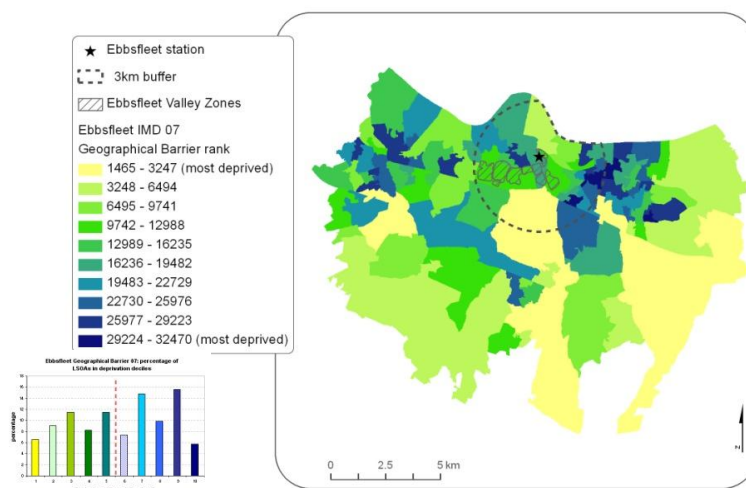


Fig. 7.36: Ebbsfleet 10 km analysis zone: Geographical Barrier sub-domain 2007 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The picture is less clearly spatially differentiated in 2007 as the two largest urban areas, Dartford and Gravesend witness a decrease in relative ranking for some of the LSOAs along the Thames (fig. 7.36 above). Areas further out see an improvement in rank order

suggesting that accessibility is relatively better to the key resources in locations previously ranked in the most deprived decile. The small bar chart supports this spatial impression, with the 2007 dispersion slightly less skewed to the 'less deprived' half of the rankings.

The map depicting the change in ranking for Geographical Barriers (below; fig. 7.37) shows clearly that the largest drop of 15,720 rank places is a LSOA located in the Swanscombe peninsular (central river-front). Its southerly neighbour, which also has a drop in rankings, are both close to the northern boundary of the proposed Ebbsfleet Valley development and alongside the CTRL rail line. Could these be factors in increasing the distance to local key resources, possibly located to the west? Some LSOAs improved by a similarly large change in rank order, but in general the pattern is not spatially clustered.

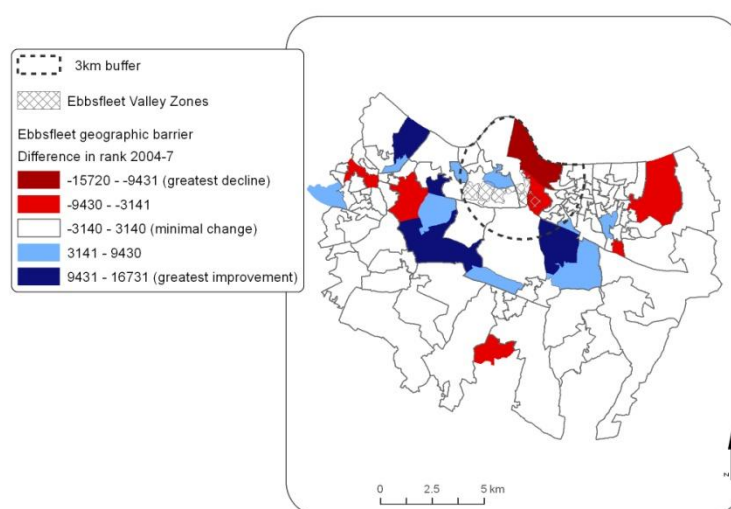


Fig. 7.37: Ebbsfleet 10km analysis zone: Geographical Barrier sub-domain changes in ranking 2004-7 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

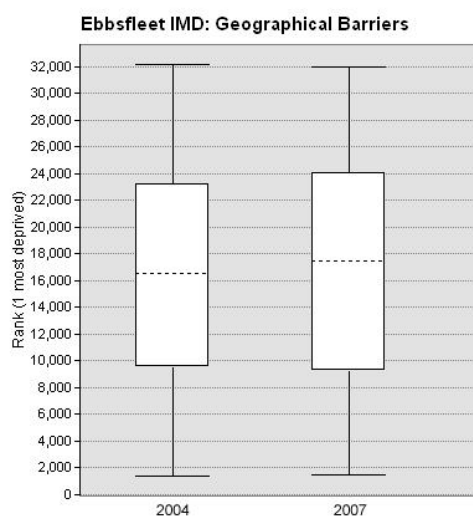


Fig. 7.38: Box plot: Ebbsfleet Geographical Barrier sub-domain changes in ranking 2004-7

The box plot (fig. 7.38) illustrates the overall decrease in Geographical barrier-related deprivation for the Ebbsfleet analysis zone, as the median rises from 16,529th to 17,463rd in 2007 and the inter-quartile range expands upwards as more LSOA rise in relative rank order. This suggests that the area has improved access to key resources between 2001 and 2005, the timeframe of the data capture.

'Entrenched' deprivation in Ebbsfleet

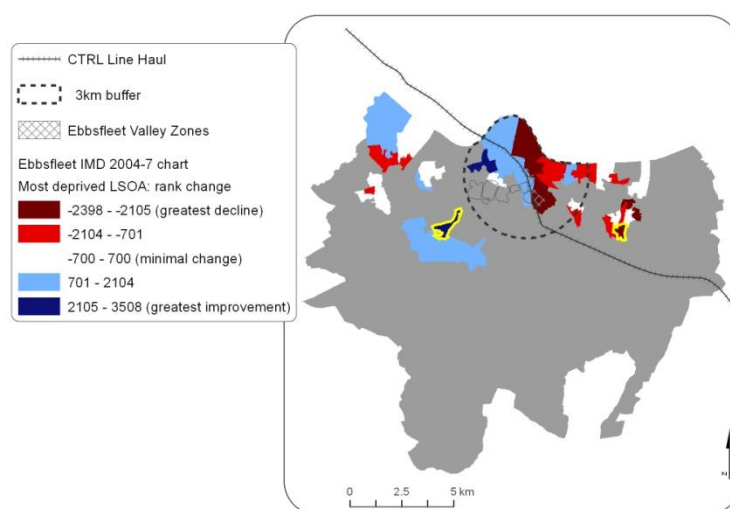


Fig. 7.39: Ebbsfleet most deprived (IMD) LSOA rank changes 2004-07 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

35 of Ebbsfleet's 122 LSOAs fall into the most deprived decile, nearly a third, confirming the level of poverty that exists in this area. Mostly located along the banks of the Thames (fig. 7.39 above), there is a mixture of rises and falls. The most extreme changes (modest by Ashford's standards of rank changes) are highlighted by a yellow outline (above), occur away from the riverfront. The largest fall occurring south of Gravesend and the LSOA with the highest positive rank change is in the urban/rural fringe of Dartford, some distance from the line haul and the 3km zone.

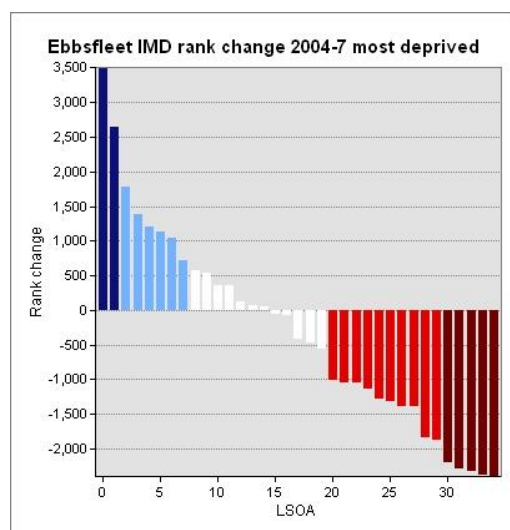


Fig. 7.40 Bar chart for the change in rankings for most deprived (IMD) LSOAs in Ebbsfleet

The bar chart to the left (fig. 7.40) illustrates the proportion of those most deprived LSOAs that continue to fall in rankings, which can be named as 'entrenched' for the purposes of later indicators, and in Ebbsfleet represent a sizable proportion (45%). In the Geographical Barriers measure (fig. 7.41 below) a smaller proportion of Ebbsfleet's LSOA are in the

lowest decile (25%) but only one LSOA with very little change is within the 3km analysis zone. Surprisingly, given the central urban location, some of the most deprived that fall the furthest in rankings are located within the centre of Gravesham to the east (the largest drop is the red polygon outlined in yellow).

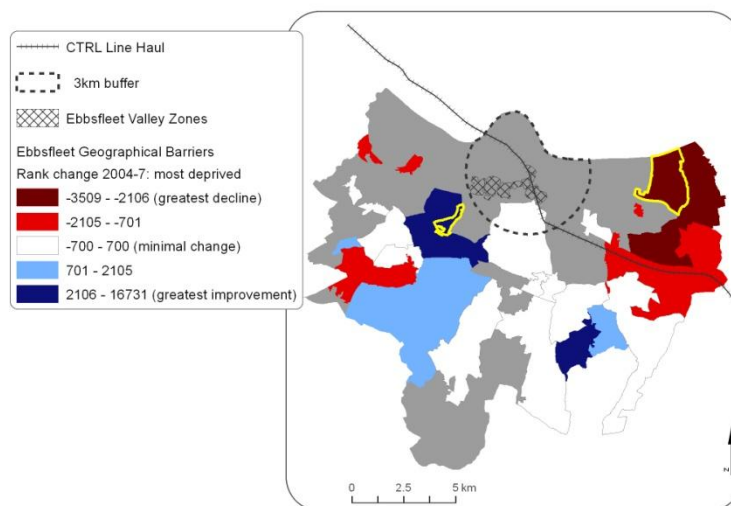
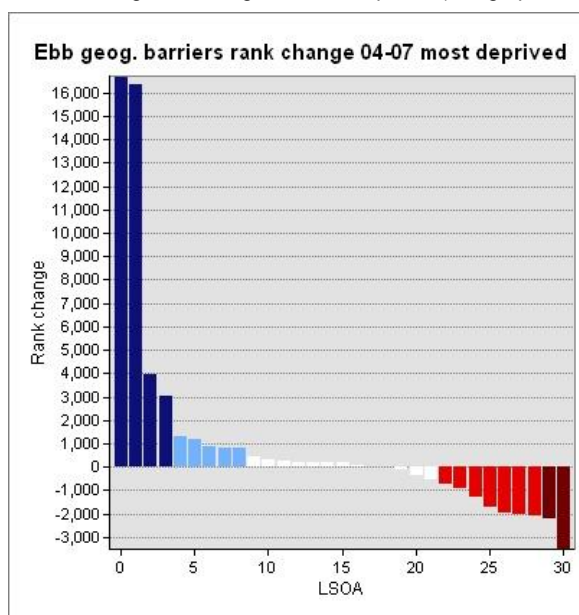


Fig. 7.41: Ebbsfleet most deprived (Geographical Barrier) LSOA rank changes 2004-07 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

Fig. 7.42 (below): Bar chart for the change in rankings for most deprived (Geographical Barrier) LSOAs in Ebbsfleet



This bar chart (fig. 7.42) clarifies that 80% of the LSOAs change between only 1000 and -2000 rankings, which suggests that generally the access to essential local facilities has remained static. However two LSOAs rise by over 16,000 places, which local planners may well have intervened with a change in road layout or a centre with new facilities has been created to bring such a high improvement for the population within those LSOAs to the south-east of Dartford.

Overview profiles of the indices: how does deprivation change?

The bar charts below are composites of the small mapset vertical bar charts, and aim to elucidate the extent by which the analysis zones varied in the short data capture period and also compared to the wider context, SE England (in the appendix 10.5). Both the IMD and the Geographical Barriers sub-indicators are represented side by side (separated by a dashed line), first for Ashford, followed by Ebbsfleet. The colour ramps replicate the rank classes used in the preceding maps.

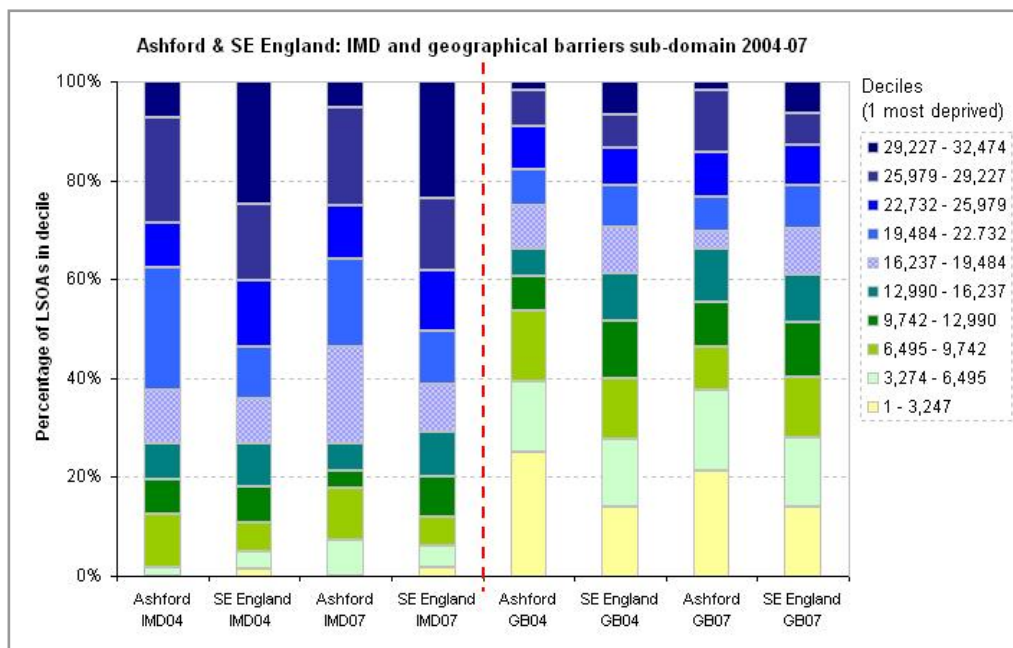


Fig. 7.43: Composite bar chart: deprivation indices for Ashford

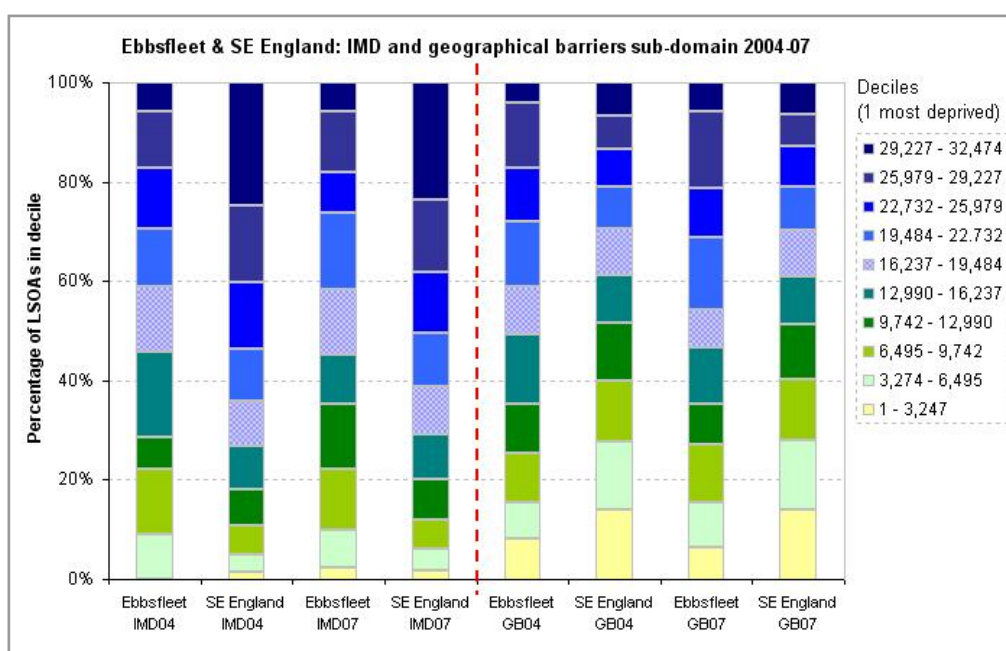


Fig. 7.44: Composite bar chart: deprivation indices for Ebbsfleet

The most immediate impression one makes from the composite charts (7.43 and 7.44) above is that, as expected, little has changed between the two time periods for either of the hubs or the SE England GOR. The lower value of the class illustrated with a blue 'hatching' is the median rank (with five deciles either side), and whilst some classes expand or retract, they retain a broadly similar profile overall. On closer inspection, one can surmise that Ebbsfleet is more deprived in the combined IMD but less relatively deprived with regards to the Geographical Barriers sub-indicator than the wider GOR, for both time periods. Ashford however is more deprived than the GOR in the Geographical Barriers sub-indicator, with 25% and 22% in the lowest decile class, in each time period. However Ashford is very similar in profile to the larger regional dispersion for the composite IMD.

The profile charts that assess the ranking order changes are presented below (and reveal a slightly more dynamic state of affairs. The method for sorting the ranking change data into the quintiles is identical to the process in creating the maps above, and the classification illustrated with the grey hatching is comparable to the white middle quintile in the maps, indicating relatively minimal change. For all indices and spatial locations, this is by far the largest class, echoing the limited overall changes witnessed in the profile chart above (7.43 & 7.44). However both Ebbsfleet and Ashford have significant rank changes when compared to the wider SE England area for the combined IMD. Whilst both hubs have around 50% LSOAs with minimal changes, both have around a third of their LSOAs decrease in rank order and only 18-25% improve in LSOAs rank order. As for the Geographical Barriers index, Ebbsfleet and Ashford have a similar percentage of LSOAs that fall in rank order but Ashford has 20% of its LSOAs improve in rank order, compared to Ebbsfleet's 11%. Both of the hubs have a more complex rank order change between time periods than the wider region, with 78% of SE England's LSOAs remaining relatively unchanged for both indices, although there are more decreases than increases in rank for the IMD and more increases than decreases in rank for the Geographical Barriers indicator in SE England.

The above inputs to the socio-economic deprivation impact indicator lead to some interesting observations about the nature of both the hubs and the indices. As the 10km wider analysis zone was created to ensure the Fastrack bus service was analysed for its full length in the accessibility measure indicator, it is clearly seen that including the area far beyond the core urban area around the station has introduced attributes to the analysis typified by more remote and/or rural landscapes. Scale is pertinent here as reducing the zone of analysis to a more centralised core is likely to have produced quite a different profile of deprivation for all domains.

The Combined Score impact indicator (chapter 8.1) below considers both the absolute and relative values in deprivation ranking between the two current periods, exploring how the most deprived LSOAs fare between the two time periods, as an example of the

methodology. As is certainly currently the case, these deprivation maps can form a basis to concentrate alleviating spatially entrenched deprivation in those LSOAs by local planners, and provide a starting point to allocate benefits following the delivery of the near-by MUDP.

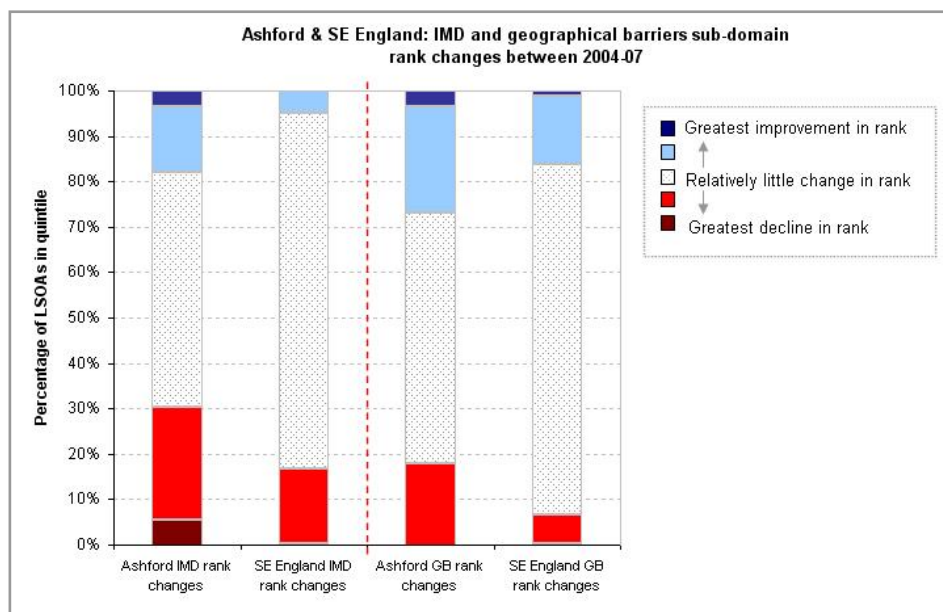


Fig. 7.45: Ashford rank changes between 2004-07 for both indices

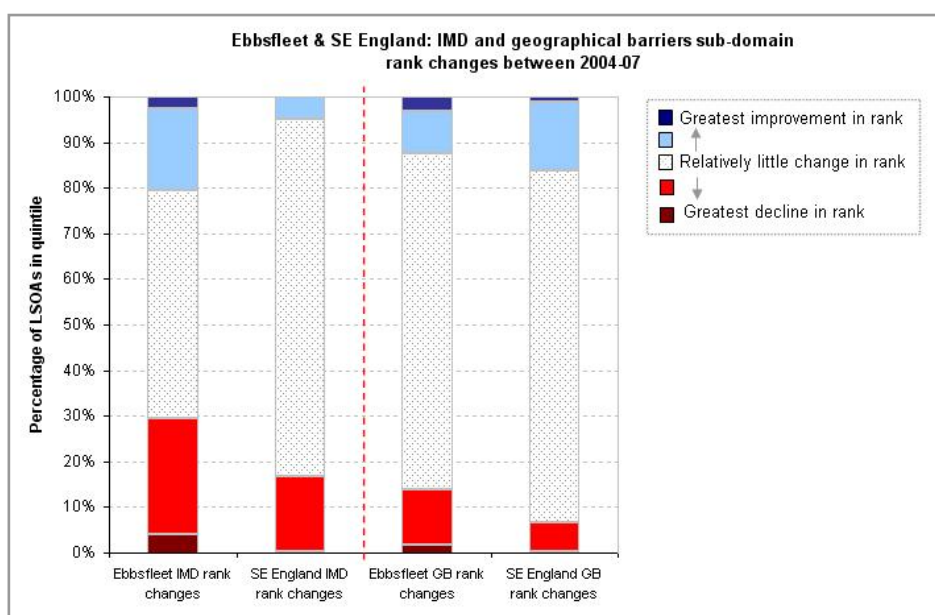


Fig. 7.46 Ebbsfleet rank changes between 2004-07 for both indices

7.2c

The Socio-economic Deprivation indicator:

Findings & critical assessment

Multiple Deprivation indicator aim

The aim of this indicator was for planners to be able to explore the potential impact that the MUDP may have had on decreasing levels of relative deprivation in areas around the hub, relative to the larger surrounding area. This suggests that the delivery of the MUDP can bring socio-economic regenerative effects to a deprived area, and that this relationship is positive.

The utilisation of two definitions of 'deprivation' was to capture the potential for positive and negative changes in deprivation brought about by the MUDP; multiple deprivation (with seven main domains) and a closer look at the Geographical Barriers sub-domain.

As qualified in the data input section (7.1b), the term 'falls in rankings' refers to where a decline in rankings between 2004 and 2007 and fell within the 5th and 4th quintile. Relatively 'minimal change' are the LSOAs that remained within the middle quintile range of all values whose median is zero (fig. 7.47). The term 'rose in rankings' refers to the LSOAs that were in either the fourth or fifth quintile, where there were improvements in rankings between 2004 and 2007.

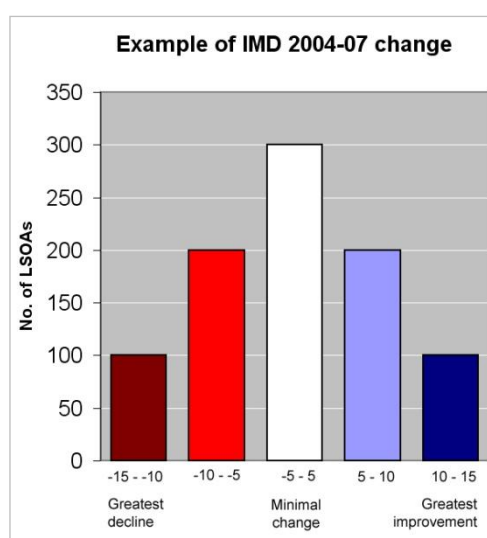
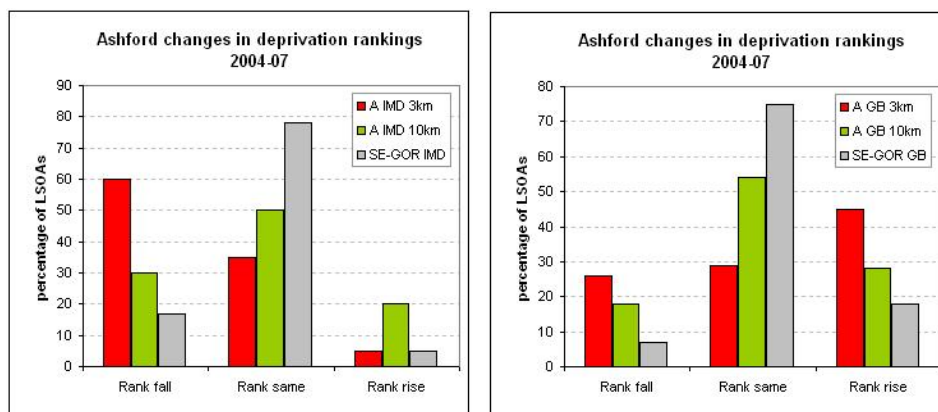


Fig. 7.47: An example of changes in rankings for LSOAs

In Ashford, the CTRL service has been stopping at the international station for the non-domestic service since 1996, yet the change in rankings between 2004 and 2007 are less 'encouraging' than Ebbsfleet (figs 7.48 & 7.49). Within the core 3km analysis zone, over 60% of the LSOAs fall in ranking, a further 35% remain the approximately the same while only just over 5% have moderate improvement.



Figs. 7.48 & 7.49: percentages of LSOAs that fall, remain the same and rise in IMD and Geographical Barriers sub-domain rankings for the core 3km and wider 10km analysis zones in Ashford, with the SE England GOR

In the wider 10km zone under 30% fall in ranking, around 50% remain the same and nearly 20% improve, compared to the general pattern in the South-East England GOR whereby a high percentage (78%) remain approximately the same. Therefore from this data exploration, the CTRL international service has not appeared to provide continuing improvements in decreasing multiple deprivation for those living closest to it in the short timeframe example. The relatively higher rank rise of 20% of Ashford's LSOAs in the 10km zone (fig. 7.48) than both the smaller 3km area and the wider GOR is positive and a pattern that would provide examples to planners of good practice. It is important to bear in mind that the LSOAs in the 3km analysis zone remains much less relatively deprived in absolute terms than Ebbsfleet, even subsequent to this fall in rankings.

In the Geographical Barriers sub-domain, the maps illustrating the rankings (figs. 7.23 and 7.24) suggest that Ashford's central area within the 3km zone has very high ranking, therefore relatively good accessibility to the nearest facilities, and over 40% continue to rise in rankings. The ranking charts for the 10km analysis zone (fig. 7.49 above) confirm that whilst 18% fell in rankings, 54% remained about the same and 28% improved. Hence this is a mixed picture between the 3km and 10km zones, although both sample areas are more dynamic than the SE England GOR, which again has a very high level of relatively unchanged LSOAs.

Road infrastructure improvements and/or more facilities in place following the continued population turnover (over 100 per 1000 resident population for every year between 2004-09 (ONS/PEU)) may account for this sizable improvement in rankings, both of which may be a result of the CTRL international (and the more recent domestic) service, although this cannot be ascertained to any extent without contextual knowledge from the town's planners. Ashford is one of the Government's Growth Regions, with a maximum planned 40,000 new homes to be constructed in the next 30 years (O.D.P.M. 2003), which the CTRL no doubt makes it an

attractive choice to move to. Along with the new residences, new schools, post offices, GP surgeries and shops would be built and will almost certainly improve the rankings for those outside of the 3km core zone.

The deprivation ranking trends in Ebbsfleet are more positive (in terms of the hypothetical MUTP benefits) than Ashford. From the final maps produced in the Deprivation indicator, one can see that the most deprived LSOAs in Ebbsfleet were located within and around the main 3km analysis zone, both in 2004 and 2007 (figs. 7.31 & 7.34). However, as seen in fig. 7.50 (below) the 3km zone did not see the greatest falls in rankings, indeed only one third declined, one third remained approximately the same and one third improved.

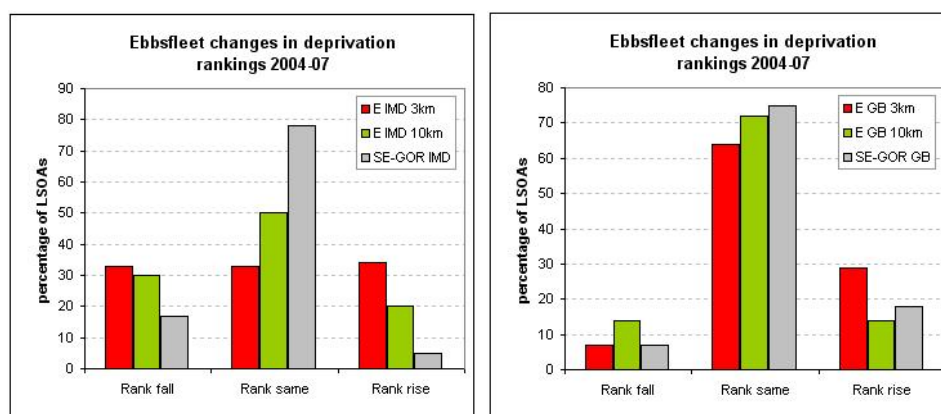


Fig. 7.50 & 7.51: percentages of LSOAs that fall, remain the same and rise in IMD and geographical barrier sub-domain rankings for the core 3km and wider 10km analysis zones in Ebbsfleet with the SE England GOR

These improvements in IMD ranking contrast with the 10km zone, where (as seen in fig. 7.50 above), less than a third fell in rankings yet only just over 20% improved while the remainder, around 50%, did not change. Whilst this is a positive outcome for the 3km zone, it should be noted that the timescale for these ranking changes (2004-2007) precedes the completion of the CTRL line haul and as such one must be cautious not to overplay the impact to the MUTP.

In the Geographical Barriers sub-domain, of approximately 7% of LSOAs decline in ranking, 64% remain the same and 29% improve (fig. 7.51 above), whereas 14% decline, 14% improve and the vast majority 72% remain relatively unchanged in the larger 10km area. This latter pattern in the final figure (7.51 above) could be considered 'optimal' in terms of reducing high levels of deprivation around the MUTP, where greater improvements than the wider spatial context are seen. As this index of rankings considers the straight-line distance to GP surgery, school, post office and general shop, the new development around Ebbsfleet station is expected to have all of these. Planners would hope that not only the residents of Ebbsfleet Valley would be able to access these, thereby increasing the accessibility rankings in this domain for residents in the surrounding community too. The improvements seen here

are possibly linked to the MUTP in Ebbsfleet regardless, and planners would aspire to the trend continuing, following the completion of the MUTP's associated developments.

With regards therefore to achieving the Deprivation indicator aim, in Ashford where the CTRL has been running a service for some time and there has been relatively little redevelopment within the 3km (and 10km) zone, the delivery of the MUTP has not seen a trend in rising rankings for the multiple deprivation score between these two time periods. Yet improvements in Geographical Barriers rankings have occurred that may or may not be coincidental. In Ebbsfleet, where the CTRL was not running a service at the time of the data collection of the IMD 2007, there is a rise in rankings equal in proportion to those LSOAs that remained the same or fell, which implies that multiple factors are influencing the IMD scores in this context possibly still linked to the imminent delivery of the CTRL (undoubtedly also the case in Ashford). The static nature of the Geographical Barriers rankings, with so many LSOAs remaining approximately the same, suggests that the MUTP has had no particular bearing on this measure of accessibility as of yet. In order to achieve the indicator aim, several issues would require consideration and clarification; where do the MUTP-influenced deprivation changes extend to – 3km? 10km? Further? How long after the MUTP delivery does it take to be measurable via the IMD – in two years will a pattern emerge in the forthcoming 2010 IMD? 10 years? More? How much does on-the-ground contextual knowledge enrich these outcomes? Does a local planner or national decision-maker know enough of the dynamics at play in these areas to make use of these data? Bearing these questions in mind, the aim is not yet met, as improvements in deprivation rankings are not enough evidence alone that the MUTP is having a positive socio-economic impact upon the residents living close to the hubs at the resolution and timeframe analysed so far; in short, it is too early to tell.

Critique of the method

The processing of the IMD datasets was comparatively straightforward, and their display within the GIS environment was of most use once classification of the values into fixed, 'global' deciles (relating to the full English range of values) was created. The addition of the bar charts to quantify the proportion of LSOAs per fixed decile brought a further useful angle to explore the changes in deprivation. As with the majority of this study, scale was an issue. Choosing a relatively arbitrary 3km circular core analysis zone and a wider 10km analysis zone (for reasons discussed in the Case Study sample in chapter 5) around the train stations creates false areal boundaries. The impact of the CTRL on local deprivation levels, if it exists at all, may be most pronounced for a different area, or a circular-shaped buffer may be too vague. Similarly the use of the IMD, whilst providing an overall picture of multiple deprivation does mask underlying changes, as seen by the closer examination of the sub-domain Geographical Barriers. Creating an 'appropriate' buffer shape may be impossible, given the 'knowable' processes involved (that is, a long timeframe to understand the cause and

effects) but exploring the IMD domains and sub-domains separately in future applications could yield some unexpected patterns that may be clearer to attribute to the impact of the MUDP.

Future guidelines for decision-makers

The Deprivation indicator example methodology has proved useful in locating areas of 'long-term' entrenched deprivation. For example the ten LSOAs in the lowest deprivation ranking quintile in Ashford are all located within the 3km zone, and only one improves, two are approximately the same whilst the remaining seven decline, one by nearly 2,800 places down the rankings (see fig. 7.30).

In Ebbsfleet, the majority of those LSOAs in the lowest ranking quintile that fall further in ranking between 2004 and 2007 are located within the core 3km zone, with some in southern Gravesend (see fig. 7.39). The greater dispersal of most deprived LSOAs in the 10km zone reflects the different pattern of population density in the area compared to Ashford, and it would be interesting to compare the rise (or fall) of those in the 3km zone over those located beyond, in subsequent IMD exercises. Moreover, of the 34 LSOAs in Ebbsfleet that are relatively most deprived, a further are 28% rising, one by 3,500 rankings, the same percentage remaining approximately the same, and 44% falling. These latter LSOAs can be considered a starting point to explore 'entrenched multiple deprivation'. Long term deprivation could also be at the source of tension, as hub residents who are absolutely deprived along several dimensions may be potentially unable to participate fully in the new community borne from the MUDP-associated developments. For example one ward 'Northfleet South' contains deprived LSOAs that continue to fall in rank located alongside the new Springhead Park development. Reducing both relative and absolute deprivation for the inhabitants of the ward may enable them to integrate more with the demographically different population of the new development.

Lessons learnt for planners and decision-makers

Specific transport-related policy intervention regarding the reduction of deprivation in and around the hubs has formed the basis for good practice in this complex area (D.E.T.R. 1998, Priya and Uteng 2009). Monitoring the situation around these hubs will undoubtedly produce context-specific successes and failures, the lessons of which could be extrapolated to some extent to other MUDPs in the future although the demographic profile and spatial configuration of a hub will most likely be the greatest influential factor. If employing the *Cynefin* decision-making framework, the deprivation changes could be deemed to be in the 'knowable' domain. As cause and effect are related albeit over a relatively longer time period, scenario planning by 'experts' is useful in the 'sense-analyse-respond' approach to reducing deprivation. Here sensing and analysing what is occurring where with the aid of the GIS maps before decisions are made how to act upon them is a good strategy.

7.3a

The Accessibility indicator:

Methodology

This indicator considers the changes in relative accessibility in the hubs for MUTP users and non-users alike, through the implementation of the MUTP feeder bus services. The ability of these feeder services to provide improved access to a range of facilities such as healthcare, schools, shops and recreational activities, potentially enhancing the quality of life for the members of the population who are able to utilise it. Both Ashford and Ebbsfleet are currently served by a network of buses, hence these indicator measures consider the increase in relative accessibility as the 'added value' these MUTP-related routes bring over the existing bus network.

Potential benefit for the MUTP appraisal

The MUTP feeder bus services are of benefit to the hub community as they can bring improved quality of life when access to jobs and other facilities and services increases, provided they are affordable.

Aim of the indicator

Even with relatively limited demographic data, an accessibility measure can capture the relative concentrations of those in the local community, constrained by socio-economic circumstances, who rely heavily upon public transport (namely bus trips see D.F.T. 2008)(). This enables MUTP-related transport planning to optimise routes so as to benefit both the MUTP commuters and those requiring affordable access to local facilities and job opportunities

Objectives

- To digitise an existing and proposed feeder Bus Rapid Transit (BRT) routes and known bus stops to create a sample urban area. BRTs are faster, more efficient services and often have priority right-of-way resulting in higher passenger miles than conventional bus services.
- To extract and overlay demographic and unemployment data to assess the potential bus ridership population
- To generate two context specific measures to consider the increase in accessibility for the community

Two approaches to accessibility are employed, one per hub so as to assess their usefulness, ease of creation and communicability of results. In Ashford the MUTP feeder bus service is

still in the planning stages therefore a route appraisal is made based on the typical transport needs of different demographic groups. The measure's outcome provides an indication of how the MUDP service can increase accessibility to the network once it becomes operational. In Ebbsfleet, the MUDP feeder bus route has been in service since 2006. With the availability of higher spatial resolution data for dwelling, facility and service locations, this measure considers the increase in accessibility to different types of employment locations for dwellings in areas of high unemployment.

Method for the Ashford accessibility measure

If the demographic profiles could provide a clearer picture of where bus travel was most needed, the MUDP could provide a catalyst for new bus routes serving those communities. This is a form of accessibility study that considers the needs of the population at the origin, rather than the access provided to opportunities at the destination.

The fig. 7.52 (below) is a display of the OAC groups where the majority of the population responded to the 2001 census regarding whether or not they used public transport to get to work. Groups that had above average (in England) use of public transport were Settled in the City and Public Housing, both located within the 3km analysis zone in Ashford. Groups that typically did not use public transport to go to work, Village Life, Agricultural, Accessible Countryside, Prospering Older Families and Least Divergent, are beyond the core 3km zone and form the majority of OACs located the 3-10km zone.

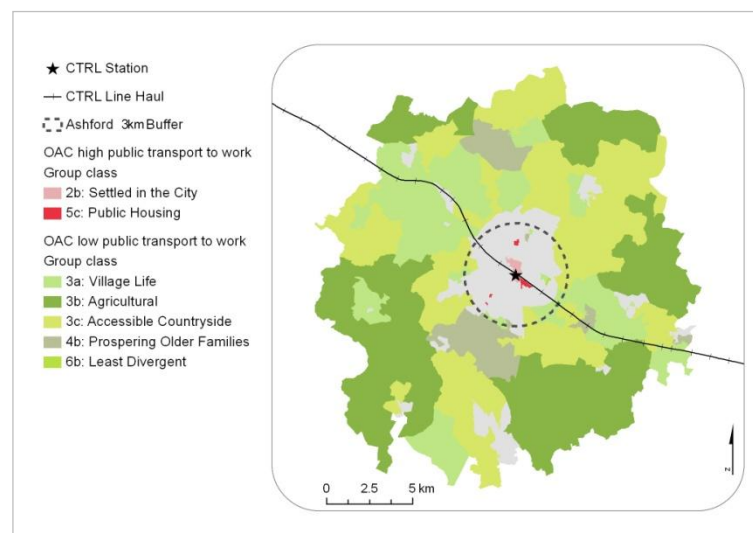


Fig. 7.52: Ebbsfleet 10km: Demographics and Travel to work [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; Contains National Statistics data Crown copyright /atabase right 2003; Ordnance Survey data Crown copyright/database right 2003]

This is a rather coarse assessment of the public transport usage of the hub, and conforms to expectations that one might have, that the population living outside the urban core rely on private transport to get to work and perform other tasks. Yet the *needs* of the population are

not assessed and consideration of the lifestyles typified in the demographic profiles could reveal more about where the population who most rely upon public transport live, guiding decision-makers to maximise the potential for MUTP-related local transport improvements.

This 'reverse' accessibility analysis (exploring the need of the population rather than the attractiveness of the opportunities at the destination) will re-appropriate the methodology of the 'Transport Needs Index' (TNI) created by Steer Davies Gleave (Duckenfield 2009). This index explores the OAC Group level data along with subsidiary travel behaviour surveys regarding bus trips and the use of the Index of Multiple Deprivation (of 2004 in their report) as a proxy for income to extract socio-economic classes related to the transport needs for bus usage. The index is primarily composed of three variables:

- Cars per adult in a household (the fewer the cars the higher the need): Census 2001
- Income (the lower the income the higher the need): IMD2004
- Ruralness (the more rural the higher the need): ONS Urban Rural classification

The index is the multiplication of the three variables, with the higher the metric, the higher the need for bus transport, with the comprehension that some variables such as higher income, will cancel out the effect of low car ownership for example, presuming that this is a lifestyle choice (Duckenfield 2009:2-4).

A scatterplot of OAC subgroups (fig. 7.53 below) with bus trip rate plotted against projected Transport Needs Index (TNI) revealed that the increase in bus trips made correlated loosely (no R^2 statistic given) with the increase in the TNI, but revealed some interesting outliers.

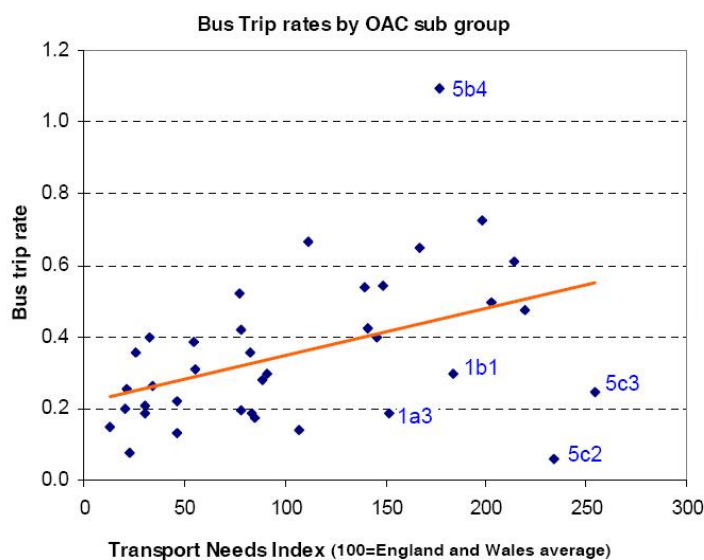


Fig. 7.53: Scatterplot for Transport Need Index in England and Wales (reproduced with permission from T Duckenfield 2009:5)

The study revealed that OAC subgroups where bus trips were low but the index suggested the need was high had above national average levels of single parent households, whilst a

subgroup exhibiting very high bus trips with projected medium need were single people in rented accommodation. These observations led to the creation of the 'Transport SuperSegments'; seven clusters of OAC groups that have their own particular set of transport needs (fig. 7.54) (Duckenfield 2009:6).

Class	Transport Needs Index		OAC groups	Key tendencies
Flats & Terraces	183	Very High	5a 5b 5c	unskilled work, unemployed, retired, poor health
Multi-cultural urbanism	171	High	7a 7b	town, city centre location, non-white ethnicity
Family challenge	157	High	1a 1b 6c	lower paid occupation, children in household
Self-sufficient singles	88	Average	1c 2a 2b	single or couple, working age, lower income
Middle Britain	60	Low	6a 6b	1 or 2 cars, children, semi-detached
Country life	38	Low	3a 3b 3c	rural location, 2+ cars
Prosperous professionals	27	Very Low	4a 4b 4c 4d 6d	high income, 2+ cars, detached housing

Fig. 7.54: Transport SuperSegment classes (reproduced with permission from T Duckenfield 2009:6) (modified: see appendix 10.6)

The original groups were balanced in order to contain around 10% of the population of England and Wales in each class, with the exception of Middle Britain (20%) and Prosperous professionals (27%), and TNI = 100 is the average index score for England and Wales. These groups were modified for this accessibility indicator (how and why is discussed in the appendix section 10.6), thereby altering the proportions of the population, but this adoption of the methodology is still useful to provide an example of how demographic profiles can enhance transport planning.

This classification based upon the OAC was originally utilised by Steer Davies Gleave to assess two potential routes for the CrossRiver Tram Project in south London. For the case-study it will be employed to consider 'SmartLink', a proposed Bus Rapid Transit (BRT) network for Ashford, to be implemented in the next few years (the initial phase is planned to be delivered late 2012), partially as a feeder service to the CTRL (Ashford Best Placed 2010). Initially the 'SuperSegment' classification of OAs of the Ashford 3km zone is carried out along the SmartLink route. An assessment is then made regarding the population with high transport needs that fall under a 400m buffer (c5 minute walk with average mobility, see Murray and Wu (2003) and O.D.P.M. (2003)) along the route. This is compared to the demographic profile of the 3km zone population to explore if SmartLink will be accessible to the population with the highest public transport needs.

Method for the Ebbsfleet accessibility measure

A more traditional accessibility measures has been carried out for Ebbsfleet, whereby the increase in accessibility to potential employment opportunity locations via the new 'Fastrack B' BRT route (fig. 7.55) is explored.

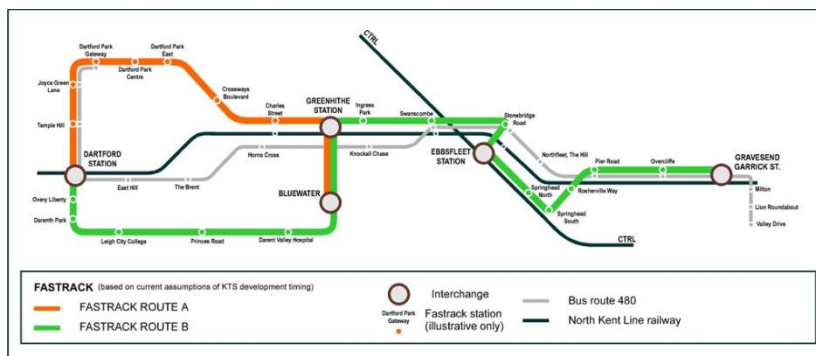


Fig. 7.55 Ebbsfleet Fastrack (©Fastrack website, accessed June 2009)

The Fastrack routes complements a significant network of existing bus routes through this Kent Thameside area between Dartford and Gravesend (see fig. 7.56 below), with relatively little new access being provided by the introduction of these feeder services besides for the new international and high-speed domestic train station. The planned full network (to coincide with the delivery of the Ebbsfleet Valley developments, currently suspended) will include a further Fastrack C route and all three will stop via the CTRL train station.

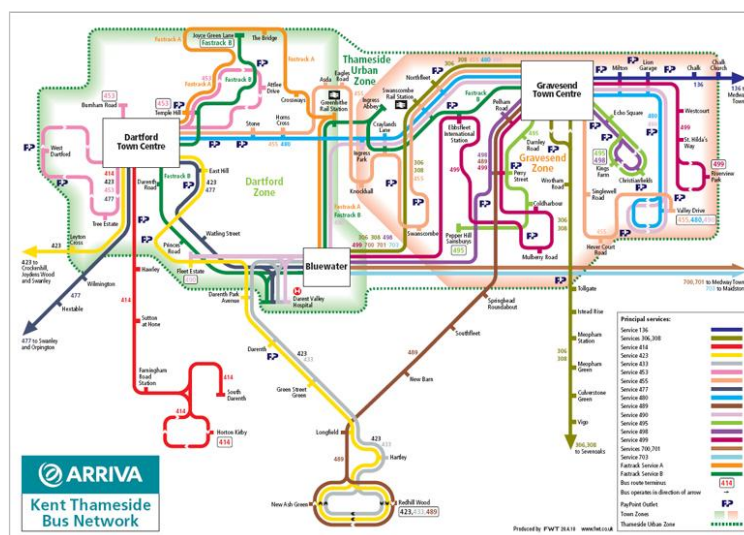


Fig. 7.56: Current bus routes through the Ebbsfleet 10km Analysis Zone (as of March 2008).

Fastrack Stone: dark green (© Arriva Buses 2008)

When selecting an appropriate accessibility measure, initially one should consider the planning issues at hand and the aim of the analysis. The data then need to be collated, processed, analysed and the accessibility measure computed, and finally the results are to be visualised and disseminated. There are several elements to an accessibility analysis that a GIS can offer unparalleled support. A GIS such as ArcMap or MapInfo is able to analyse, manipulate and display spatial and non-spatial data, augmented further by the use of spatial, network and 3D analysis extensions to explore real-world transportation systems and geo-referenced socio-economic and land-use databases. Another powerful tool in GIS is the ability to overlay different layers of information and then link them through spatially defined

units, for example origin and destination zones to be linked to Census tract data or topographical data (not without some issues, such as modifiable areal unit problem mentioned above). As a spatial database, it allows users to change the variables or parameters of an accessibility measure in a fairly straightforward way, re-generating the map output for comparative analyses. As discussed below, GIS can elucidate complex processes by way of displaying relatively simple visuals to model surfaces such as buffers, polygonal zones, grid cells or contour lines, which are very powerful in communicating ideas (Arentze et al. 1994:343-44, Liu and Zhu 2004:110).

There are two fairly distinct technical approaches that researchers have taken in using GIS as a tool with which to analyse accessibility, within which there are three integral components; implementation, data access and user-interface (Geertman and Ritsema van Eck 1995:72). Lui and Zhu employ the term 'close coupling', whereby the modelling program is embedded within the GIS, as opposed to a looser integration, sometimes called 'stand-alone' where the accessibility model feeds into the GIS via ASCII or binary data format. There are advantages and disadvantages to both approaches, namely that less integration usually means less programming in the GIS environment but can lead to increased errors and more complex data transfers, whilst the reverse is true for tight coupling along with the added benefit of a shared user interface (Liu and Zhu 2004:106).

In the diagram below (fig. 7.57 below from Liu and Zhu 2004), a suggested flowchart illustrates the multiple elements that make up a potential 'integrated' GIS approach to accessibility analysis from concept formulation, through measure selection and specification through to interpretation and evaluation. Again with reference to the GIS 'workflow diagram' (fig. 7.57), the problem definition within this accessibility indicator is the change in the level of relative accessibility for those in high unemployment areas to 'suitable' employment locations. The transport data are the digitised bus route between Dartford and Gravesend via the CTRL international station and its stops. The base land-use data for the Ebbsfleet measure are potential employment locations, extracted from OS MasterMap Address Layer 2, that fall within a 400m buffer (5 minute walk for those with average mobility) around each Fastrack B bus stop. The locations of dwellings within the 400m bus stop buffers are similarly extracted. Further socio-economic data includes the level of unemployment, which reduces the number of dwellings further by selecting only those dwellings in OAs with over 50% unemployment recorded in the 2001 Census. The Output Area Classification (OAC) system and public 'Transport Needs Index' (TNI) are also incorporated into the measure's final assessment as typical generalised traits of the dwellings' occupants.

The origins and destination zones are the aforementioned bus stop buffers with dwellings and/or employment locations within 400m, and the attractiveness of the destination bus stop buffer zone is the number of potential employment locations within 400m of the stop. The

origin-destination matrices between the dwellings and different classes of employment types at the locations are generated via the ArcGIS 9.2 Network Analyst toolbox.

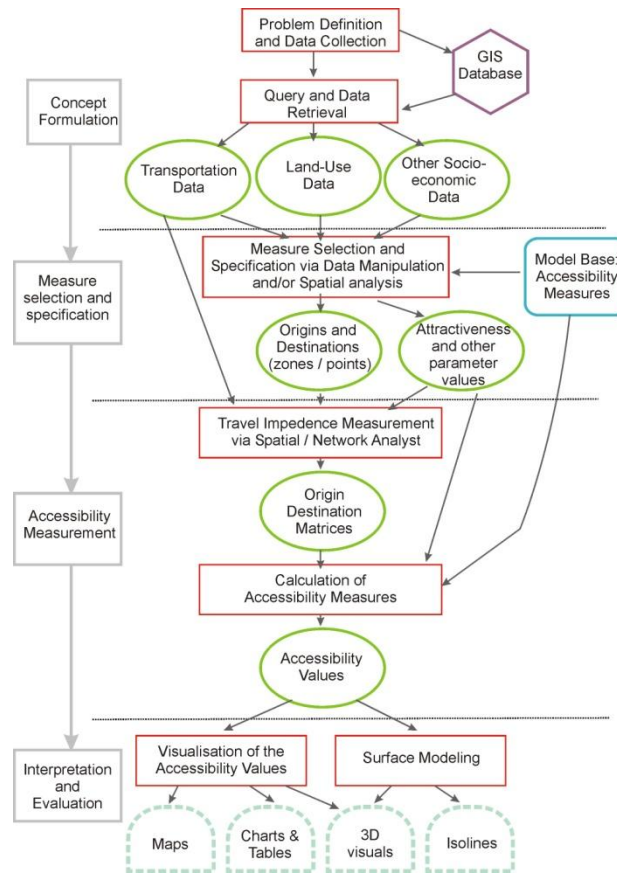


Fig. 7.57: A workflow for a GIS-based accessibility measure, derived from Lui and Zhu (2004)

For the Ebbsfleet accessibility measure, the ‘classical potential equation’ (from Geertman and Ritsema van Eck 1995:69) a derived gravity-based measure (as described in chapter 2.1) was modified to suit the purposes of this study. The strengths of this measure include the ease of generating the measure and its communicability, whilst shortcomings include the lack of inclusion of variables such as capacity or demand. However, as communicability is a key element of the indicator set, and there is no readily available capacity or demand data for the bus service, this measure is appropriate for our needs. The measure is as follows:

$$A_i^x = \sum_j \frac{E_j^x}{(t_{ij}^1 + t_{ij}^2 + t_{ij}^3)^\alpha}$$

Where A_i^x is the accessibility measure for the nearest dwellings within 400m to bus stop i , and E_j^x is the number of all employment opportunity locations within the 400m buffer of destination bus stop j . Note that the superscript ‘X’ is used for ‘BC’: blue collar, ‘RC’: recreational, ‘RT’: retail and ‘WC’: white collar, for employment specific measures. This value is then divided by t_{ij} the travel time from zone i to zone j , which has been trisected further to assess an approximate multimodal journey time hence t_{ij}^1 is the average walk time from each

dwelling to the nearest route B bus stop (the 'origin' bus stop). Hence t_{ij}^2 is the bus travel time from the origin bus stop to any employment 'destination' bus stop designated by the route B bus timetable (Fastrack 2010), and adjusted to be an average travel time for both on and off-peak journeys. Finally t_{ij}^3 is the average walk time to any employment opportunities within the 400m of the nearest 'destination' bus stop.

The final parameter is α , a distance decay function that is generally set between 1 and 2 to reflect the rate of increased friction due to increasing distance. As there is no local study on which to base this value, it has been set provisionally to 1.5, although this value makes little difference to the relative accessibility measure of each stop in such a simple linear study.

This measure is not particularly sophisticated but reflects well the goals of the measure, and is straightforward to understand the inputs and communicate the results to planners. In general it is clear that the lower the total t_{ij} (the combined walk-bus-walk time) value, and higher the E_j^x (number of potential employment locations within 400m of the bus stop) value, the higher the accessibility. The final A_i^x (or A_i^{BC} , A_i^{RC} , A_i^{RT} , A_i^{WC}) figures are cumulative values hence mask the individual pairs of accessibility but give an overall impression of the level of additional accessibility the bus route B gives to these areas of high unemployment over the existing transport network and/or walking locally.

Further parameters for the measures are the cut-off times for the travel impedance which includes disregarding all t_{ij}^2 values that are below 1.6km (roughly up to 4.3 minutes bus travel time) as this is approximately up to 20 minutes walk (with average mobility). It could be considered, given the general dispersal of dwellings and employment opportunities, to be counter-intuitive to catch the bus when walking to any opportunities within this distance would almost always be faster 'door-to-door'. Similarly, any journeys over 11km (approximately 30 minutes bus travel time) was excluded as this was felt to be a limit that the bus route would be utilised in daily commuting, and this means that all total journey times for walk-bus-walk are under 40 minutes. This correlates with the upper journey time threshold used in the Government's Core Accessibility Indicators (D.f.T. 2009a). As the walk times for t_{ij}^1 and t_{ij}^3 are averages from each dwelling to the nearest 'origin' bus stop, this is likely to be faster than real-life times since this is merely a straight-line calculation from the dwelling point or employment point locations to the bus stop point and disregards the street network layout.

Future guidelines for planners and decision-makers

Accessibility measures are an integral part of transport appraisal frameworks already (exploring travel time savings, mode shift, reduction in congestion for example). This measure draws attention to the extra, distributive effects a MUTP feeder service can bring, not only to MUTP users but other members of the community. Routing of the services can

therefore be guided by the needs of both; access to the MUTP and those in need of good quality, reliable and affordable bus trips.

Lessons Learnt for planners & decision-makers

Accessibility is proposed as an impact in the 'known' domain of decision-making. This includes all the access-related indicators such as 'Impeded Access' in the Physical Barriers indicator, Geographical Barriers in the preceding Deprivation indicator and the 'Jobs Accessible in under 20 minutes by Public Transport' in the Social Exclusion indicator. This domain of decision-making is relatively stable and simple, with relatively repeatable and predictable cause and effect, and the variables reasonably straightforward to control and adapt. Decision-makers and planners can 'Sense-Categorise-Respond' to explore how the feeder bus services are serving the community and optimise the route and pricing, building up a framework of best practice for future feeder routes.

Cross-influence with meta themes

The potential gravity-based model for Ebbsfleet is included within the Social Exclusion meta indicator, as improved accessibility is a key factor in the drive to reduce unemployment-related social exclusion.

7.3b

The Accessibility Measures: Input data and output maps

The Ashford accessibility measure: SmartLink

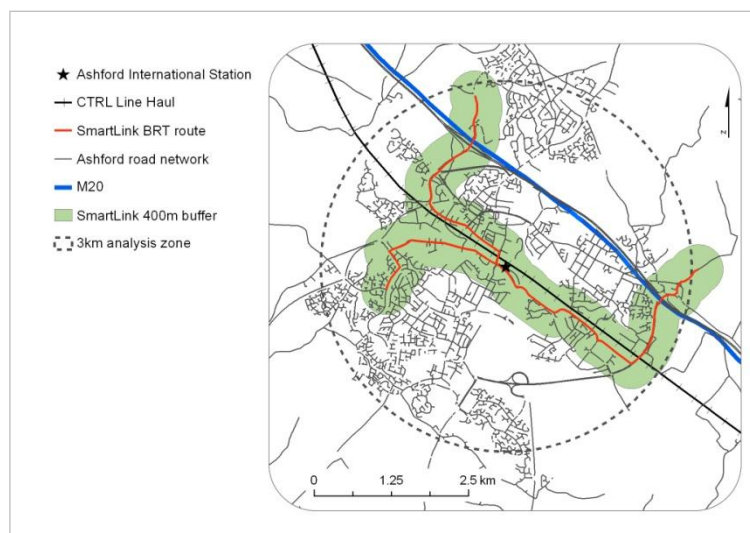


Fig. 7.58: Ashford 3km zone: SmartLink BRT proposed route Phase 1 [Integrated Transport Network datasets ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The map above (fig. 7.58) delineates the proposed Phase 1 of the SmartLink bus route, due to commence service in late 2012. The 400m buffer captures the suggested spatial limit that the population would be prepared to walk (up to 5 minutes)) to catch the service. However, specific locations of the bus stops are not currently available to refine the buffer. This new feeder service will connect to the Park & Ride, commercial shopping centres, new housing developments and business parks across Ashford.

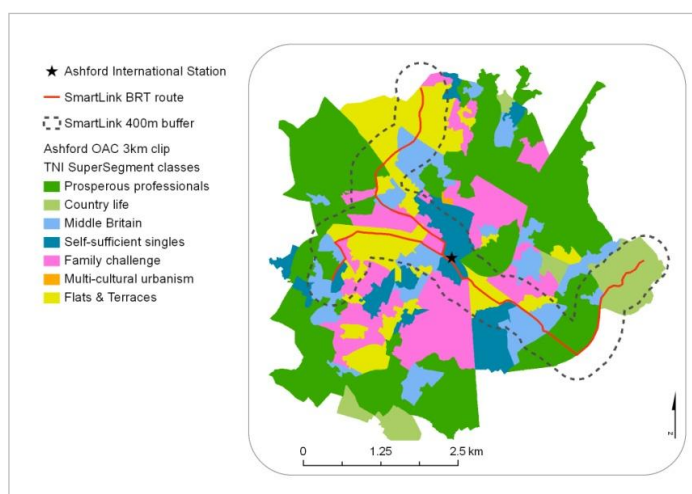


Fig. 7.59. Transport Needs Index: SuperSegments classification in Ashford 3km zone [Duckenfield 2009, 2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

Fig. 7.59 (above) displays the dispersal of the 'SuperSegments' as per Steer Davies Gleave's Transport Needs Index (TNI) study discussed above in the methodology (Duckenfield 2009). This has been modified for this indicator so that each OAC group in the 3km analysis zone is allocated to a single class (see appendix 10.6 for details of these changes).

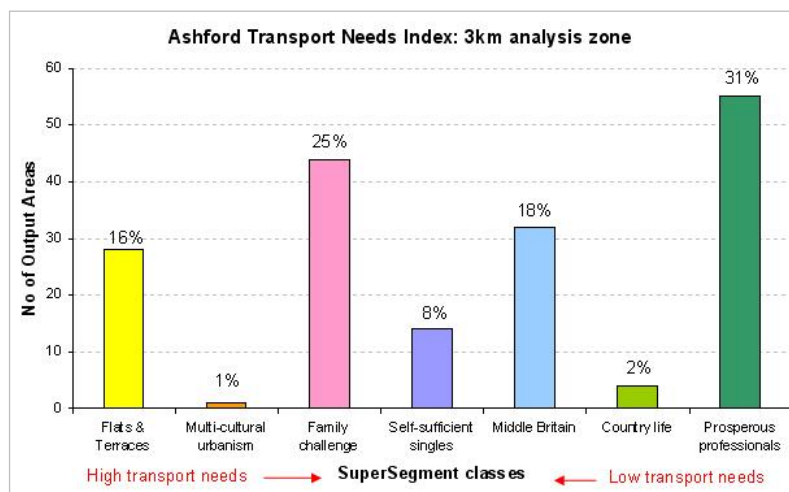


Fig. 7.60: Vertical bar chart: Ashford 3km analysis zone SuperSegment classes

The SmartLink route passes through all the classes except for the small cluster of Multi-cultural urbanism, and the vertical bar chart above (fig. 7.60) illustrates the proportion of the SuperSegments within the 3km zone. Prosperous professionals make up the largest class (31%) followed by Family challenged (25%) and Flats and terraces (16%).

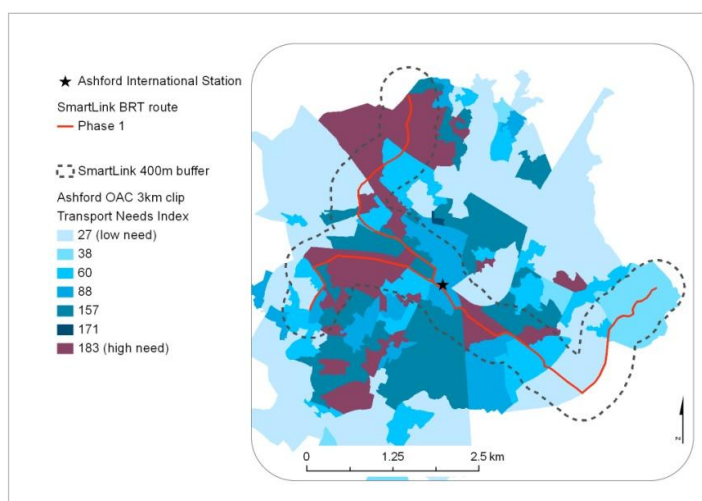


Fig. 7.61: Ashford 3km analysis zone: Transport Needs Index [2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

Fig. 7.61 (above) illustrates the SuperSegment data which has been transformed to display the 'Transport Needs Index' (TNI) associated with each SuperSegment class (Duckenfield 2009). It is evident that those areas with the highest needs for public transport are spread

throughout the majority of the 3km analysis zone, many of them within the 400m (c5 minute walk) buffer of the SmartLink route. In order to define the demographic profile of the population within the 400m SmartLink route alone, the OAs whose population weighted centroids fall within the 400m buffer were extracted (fig. 7.62).

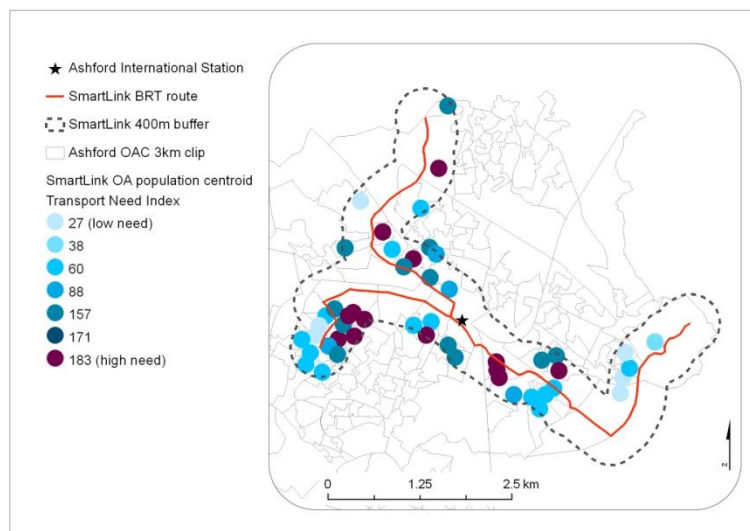


Fig. 7.62: Ashford SmartLink bus route: TNi centroids [Integrated Transport Network datasets ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The population levels of this subset are calculated (assuming the average of 264 people per OA (National Statistics 2010) as described in fig. 7.63 (bar chart below). This chart indicates that 50% of those living within a 5 minute walk of the proposed bus route are either in SuperSegment classes Flats & terraces (26%) or Family challenge (24%). Both of these classes have relatively high public transport needs. The Middle Britain class makes up a further 28%, but has below average transport needs. The lowest two classes; Country life and Prosperous professionals make up the remaining 14% of the total.

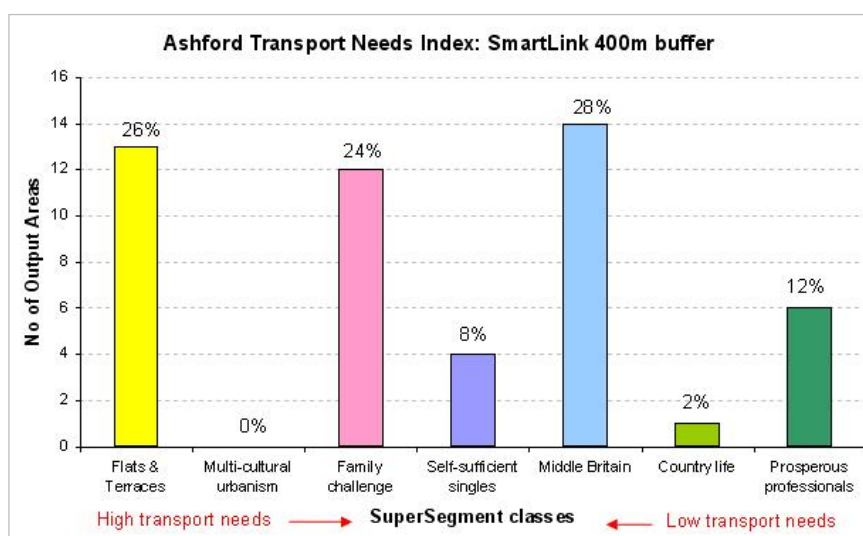


Fig. 7.63: Percentages of population within each SuperSegment under 400m from the SmartLink route

The differences in class proportion of the 400m buffer sample population and the wider 3km analysis zone population are calculated. Transport planners could consider serving the highest proportion of the population with high public transport needs as a central objective of the service. If this were the case, the planners would anticipate seeing a positive increase in the proportion of the high needs population within the route buffer compared to the wider 3km zone population. There would be a corresponding decrease in the proportion of the population in the SuperSegment classes that have a low public transport need index value. The differences in the case-study population are described in fig. 7.64 below.

Class	3km clip			smartlink			% DIFF
	# OA	PopnEst	%	# OA	PopnEst	%	
Flats & Terraces	28	7392	16	13	3432	26	10.3
Multi-cultural urbanism	1	264	1	0	0	0	-0.6
Family challenge	44	11616	25	12	3168	24	-0.7
Self-sufficient singles	14	3696	8	4	1056	8	0.1
Middle Britain	32	8448	18	14	3696	28	10.0
Country life	4	1056	2	1	264	2	-0.2
Prosperous professionals	55	14520	31	6	1584	12	-18.9
Total	178	46992	100	50	13200	100	0

Fig. 7.64: The difference between core 3km zone and 400m bus route buffer sample populations in Ashford

The bar chart (7.65 below) illustrates that the SuperSegment class that has the highest transport need makes up proportionally 10% more of the bus route buffer population than the larger 3km analysis zone population. There is a small proportional decrease in Multi-cultural urbanism (the single OA is not within walking distance of the route), and a -1% proportional change for the Family challenge class, although it makes up a quarter of all OA within the 3km analysis zone.

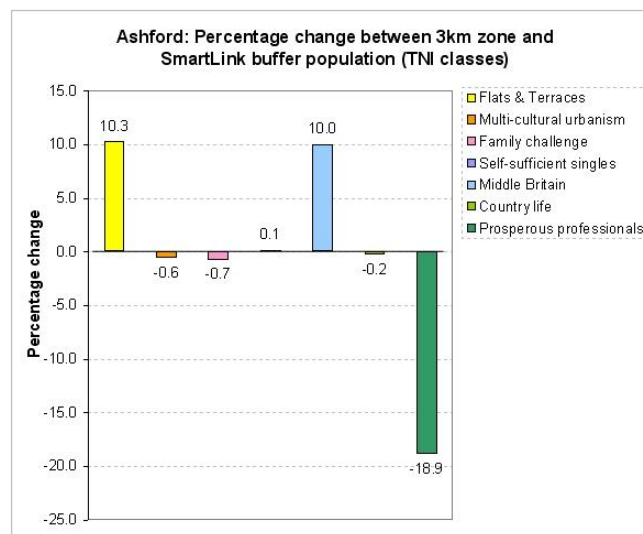


Fig. 7.65: Bar chart proportional differences between the 3km zone and bus buffer zone populations

Self-sufficient singles hardly change, but Middle Britain OAs are proportionally higher, although they have slightly below average transport needs. The two classes with the lowest needs have a combined decrease of nearly 20%. The Middle Britain class may however be an ideal potential group to encourage onto a feeder service, from using their cars to access the CTRL.

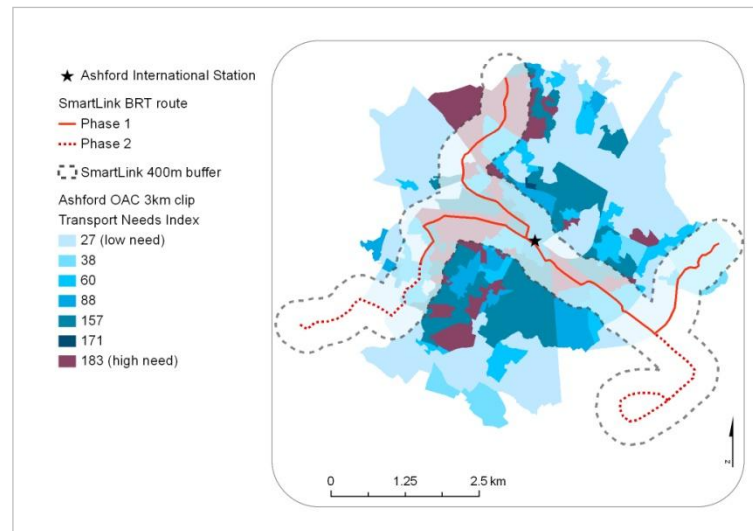


Fig. 7.66: Ashford SmartLink Phase 1 & 2 and Transport Needs Index at Output Area level [2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

Phase two of the SmartLink BRT project is estimated to commence between 2014 and 2021 to service new communities to be developed on the outskirts of the 3km analysis zone in areas that are currently agricultural and rural villages. The extended route is illustrated in the map above (fig. 7.66) with the red dotted line, and the 400m buffer is shown so as to partially mask areas to be covered by the service. Currently the second phase of the service will not respond to those areas that have a higher than average transport need and are not within a 5 minute walk of the route (see fig. 7.66 above), shown in dark red and blues. It is useful to note that this is not to imply that the requirements of those in the high need classes are not being met by other bus services, of which Ashford has many (appendix 10.7). This indicates only that this new MUDP-related feeder service has not optimised the route to that specific end.

Overlaying the SmartLink Phase 1 and 2 buffer on to the IMD rank change map (from the previous impact indicator) for the same area reveals that the route covers some of the Lower Super Output Areas that have decreased in deprivation ranking from 2004 to 2007 (fig. 7.67 below). Some areas with decreased deprivation rank correlate spatially with the OAs that have relatively high transport needs. However some are theoretically excluded from accessing this new bus service due to time taken to access the network, although these are communities that could benefit from positive second-order impacts of the MUDP.

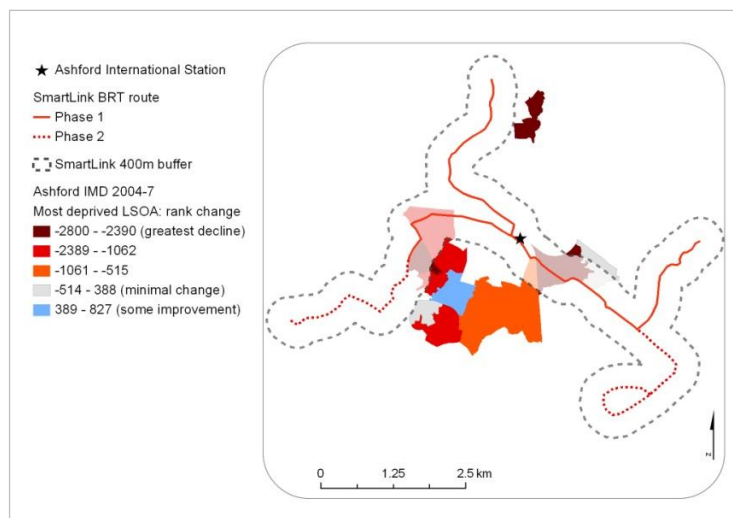


Fig. 7.67: Ashford SmartLink Phase 1 & 2 and Index of Multiple Deprivation Rank change 2004-7 [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The Ebbsfleet accessibility measure: Fastrack

This analysis is to be carried out to explore the changes to accessibility to potential job opportunity *locations* (irrespective of the number of potential employment opportunities at that location). The inputs for the measure are those households located in the Output Areas with the highest levels of unemployment (2001 Census). The map below (fig. 7.68) shows the concentration of the quintiles (Jenks natural breaks) of unemployment at Output Area (OA) level in Ebbsfleet analysis zone, along with the Fastrack B bus route and bus stops.

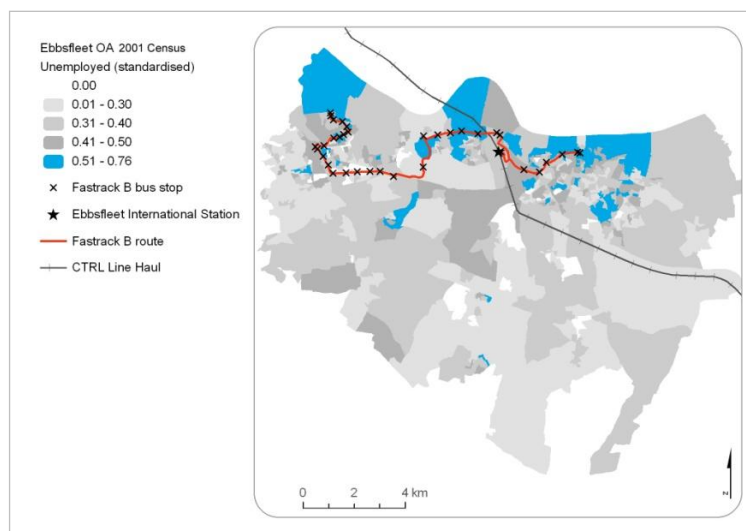


Fig. 7.68: Ebbsfleet analysis zone, unemployment and Fastrack B route [2001 Census ONS, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

In the analysis, only those OAs with over 50% unemployment are included so as to assess the potential benefits of better accessibility to potential job locations to areas with the highest concentrations of unemployment (marked in blue in fig. 7.68 above). Some of these areas

are located around the Fastrack B route. To limit the input data further, 400m (c 5minute walk) buffers are generated around each bus stop to create new subset areas (fig. 7.69 below).

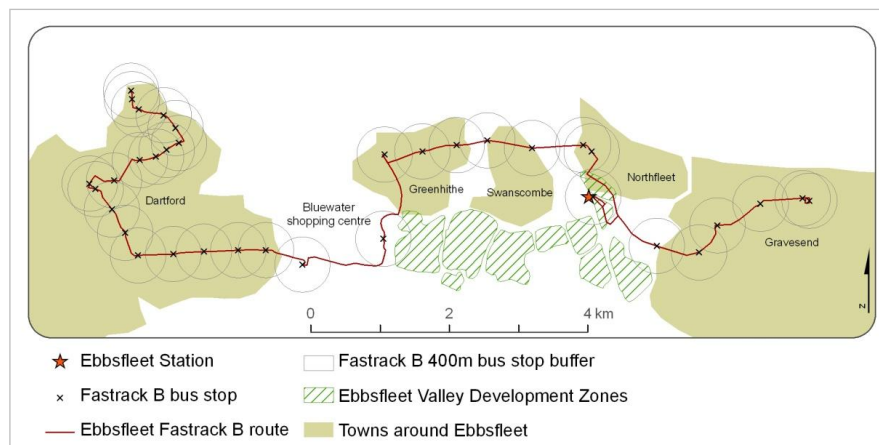


Fig. 7.69: The communities along Fastrack route B (referred to in the text below) and the 400m bus stop buffers

Extraction of point data from the 'Address Layer 2' dataset (Ordnance Survey Master Maps) led to the selection of dwellings that fall within these 400m buffers, and that are also within the highest unemployment OAs. A total of 3,328 households were included in the measure, although it is accepted that there is an element of ecological fallacy in doing so as only some of these dwellings have unemployed people of working age. Nonetheless this is the highest resolution of data available and suffices for the purposes of this measure. Disaggregating the highest unemployment level quintile into further quintiles allows a closer look at the dwellings along route B (fig.7.70). Relatively high unemployment exists along the whole route, although the highest levels are in the east, in Northfleet and Gravesend.

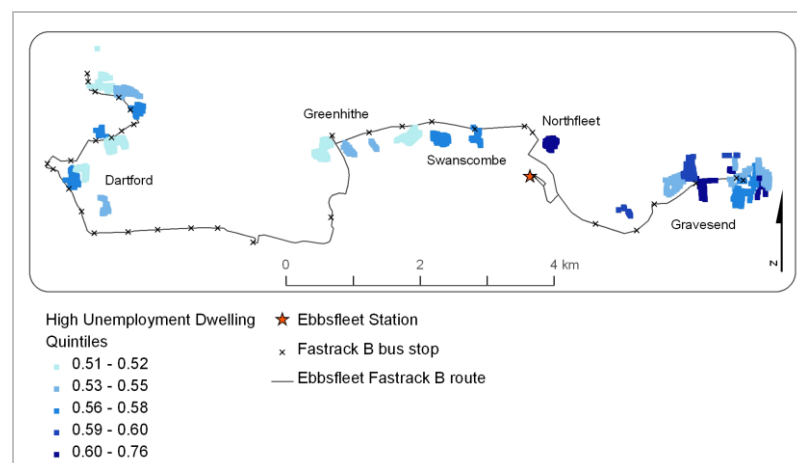


Fig. 7.70 Fastrack B and unemployment at dwelling level within 400m buffers of the stops [Mastermap2 2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Utilising the Output Area Classification (at 'Group' level) reveals that there are eight groups of geo-demographic types within these high unemployment households, from Blue Collar Workers to Settled in the City to Asian Community (fig.7.71). In assessing the OAC group details (O.N.S. 2001), despite their different nomenclatures, many of these groups share

many similar traits that are higher than the national average aside from high unemployment. This includes living in terraced housing, a lack of higher education qualifications, lone parent households and the use of public transport for work.

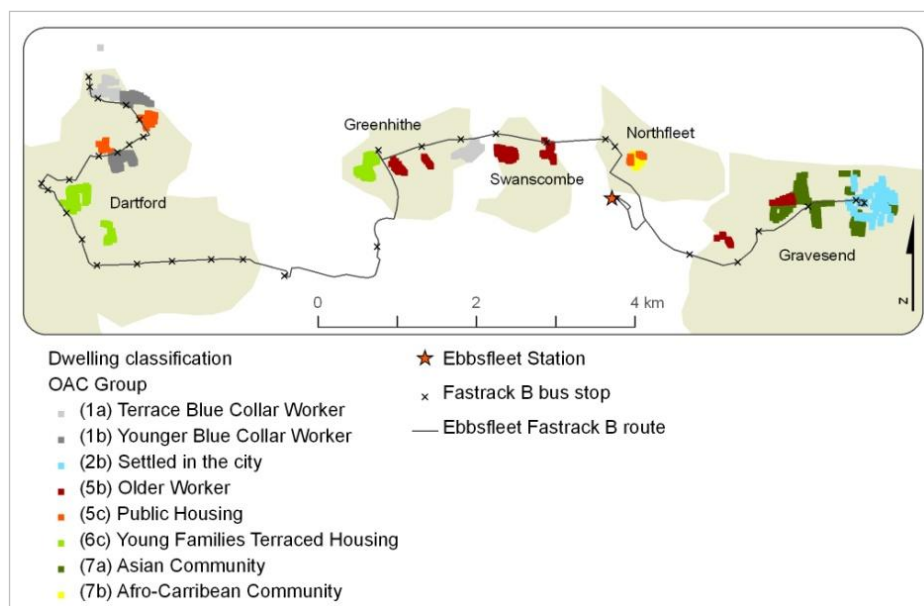


Fig. 7.71. Fastrack B dwellings and Output Area Classifications at Group level [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

The Terraced Blue Collar Worker class has two OA clusters; northern Dartford and Greenhithe, and Younger Blue Collar Worker classed dwellings are also in two clusters, both located in northern Dartford. Settled in the City comprises four different OAs all located contiguously in Gravesend. Older Worker dwellings are the most spatially distributed, in six clusters, and Public Housing is in either northern Dartford or Northfleet. Young Families in Terraced Housing are primarily in south Dartford with a separate cluster in Greenhithe. Finally the 'Asian Community' class, in six different OAs is highly concentrated in western Gravesend with a very small cluster of Afro-Caribbean located in Northfleet.

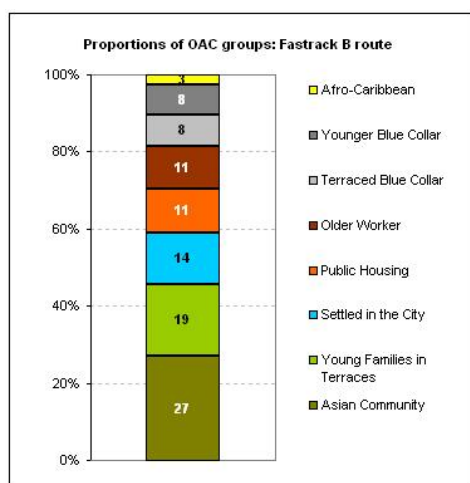


Fig. 7.72: Fastrack B Output Area Classifications at Group level and relative percentages of numbers of dwellings

From fig. 7.72 above, it is evident that the Asian community is the largest OAC grouping but are greatly concentrated in the east where there is high level of multiple occupancy dwellings (fig.7.73 below):

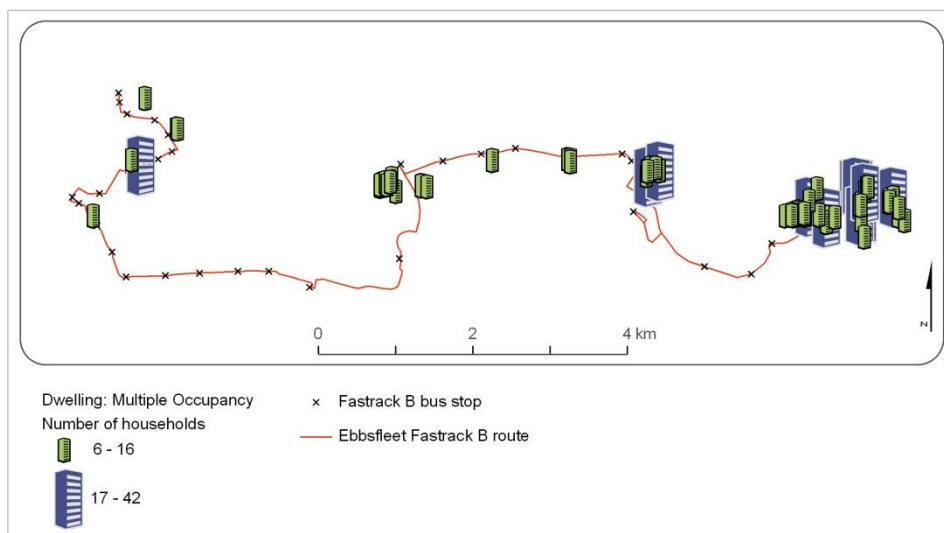


Fig. 7.73: Fastrack B and the location of high level multiple occupancy [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Adopting the Transport Needs Index from the Ashford accessibility methodology above (Duckenfield 2009), it appears that the dwellings in OAC classes that typically have high public transport needs (in red) are located along the whole route (fig. 7.74) and make up over one fifth of the dwellings (fig. 7.75).

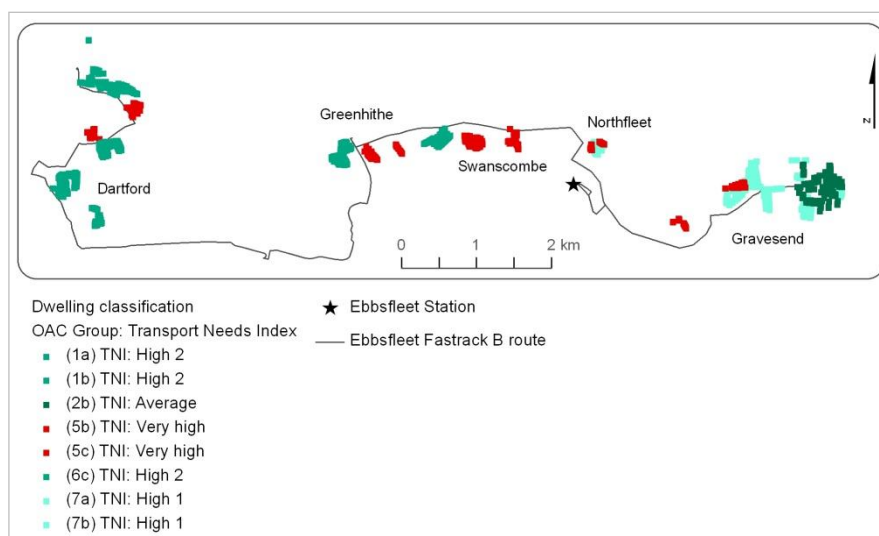


Fig. 7.74: Fastrack B dwellings and Transport Needs Index levels [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Settled in the City OAs in Gravesend typically have average public transport needs but are surrounded by dwellings OAs with typically upper high (High 1) needs, concentrated in Gravesend and also Northfleet.

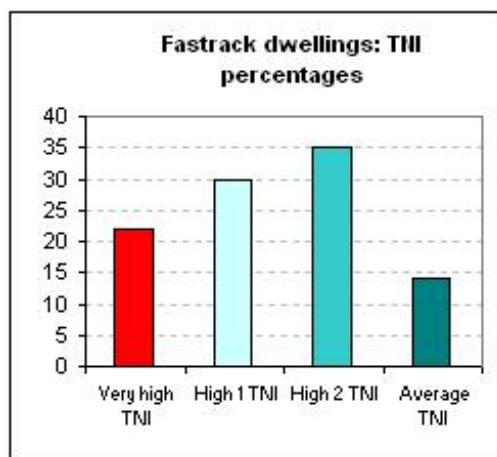


Fig. 7.75: Bar chart: percentages of Fastrack B dwellings and Transport Needs Index levels.

The lower high need group (High 2) are spread along the route from Swanscombe to Dartford and make up the largest proportion of the transport needs index at 35%.

Employment opportunity locations

The location of local facilities and services are extracted from the OS MasterMap Address Layer 2 dataset, providing the basis for accessibility to most 'opportunities' that people would require such as schools, healthcare and shops. However this can be transformed conceptually into potential job locations and grouped into four classes; Blue Collar, Recreational, Retail and White Collar opportunities within 400m (c5 minute walk for average mobility) of a Fastrack B bus stop (fig. 7.76).

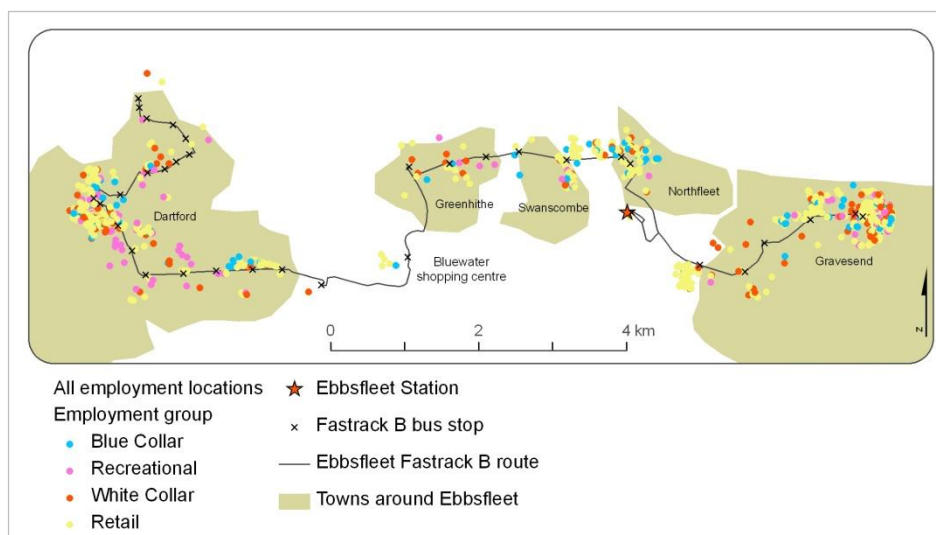


Fig. 7.76: Locations of four classes of potential employment opportunities locations under 400m from a bus stop
[2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey Mastermap2 /EDINA Digimap]

It would have been possible to designate the employment types as primary (agricultural, fishing etc.), secondary (manufacturing etc.) and tertiary (service sector/industries) but an overwhelming number of opportunities would be in the tertiary sector, as is typical in the

western world. Therefore four arbitrary classes are formed with approximately the same number of *types* of employment in each and designated a name that typifies the category of employment. 'Blue collar' is roughly considered employment opportunities that are manual in nature, typically carried out by the working classes and earning a wage paid by the hour. In this study services such as hairdressers, care homes, garages and factories are included. Private offices, local government offices, and banks along with all the healthcare and education employment locations dominate 'White collar' employment opportunities. 'Recreational' covers employment opportunities such as those in eating, drinking and sports locations. The final class is 'Retail', which incorporates supermarkets, garden centres and retail parks as well as the ubiquitous 'general commercial' local shop.

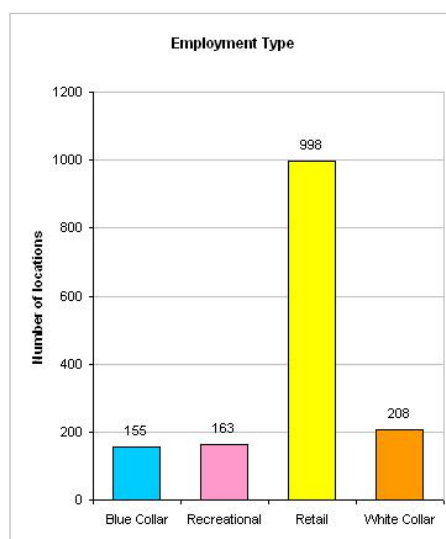


Fig. 7.77: Number of locations per employment opportunity class

This graph (fig. 7.77 above) indicates that there is around five times the amount of retail employment opportunity locations over the other three classes, but this is accounted for by many local shops with only a few employees (and therefore limited opportunities). This can be compared to a hospital for example (in the 'white collar' class, although there are a range of employment types within a hospital setting) that has many hundreds of employees. Therefore the points on the map in fig. 7.76 only account for the location of opportunities rather than the true reflection of numbers of opportunities, and is one of the fundamental deficiencies with the accuracy of the measure that cannot be overcome easily without incorporating up-to-date information regarding current job vacancies, such as NOMIS data (O.N.S. 2011).

Outputs for the accessibility measures

Utilising the Network Analyst toolkit in ArcGIS 9.2, Origin-Destination matrices were generated to explore variability in the access to different employment opportunity classes as well as all the opportunities together and access to the high-speed railway station:

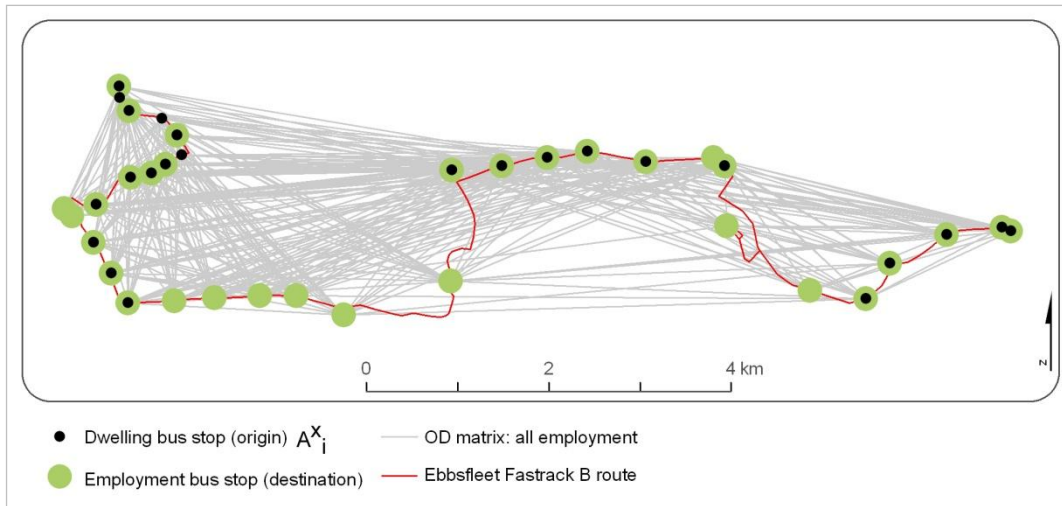


Fig. 7.78: Example of an OD matrix for the Fastrack B route

Whilst the graphical output in fig. 7.78 of the matrix are straight lines between the origins and destinations, the bus travel times in the measure are derived from travelling along the road network.

All employment opportunities (A_i^x)

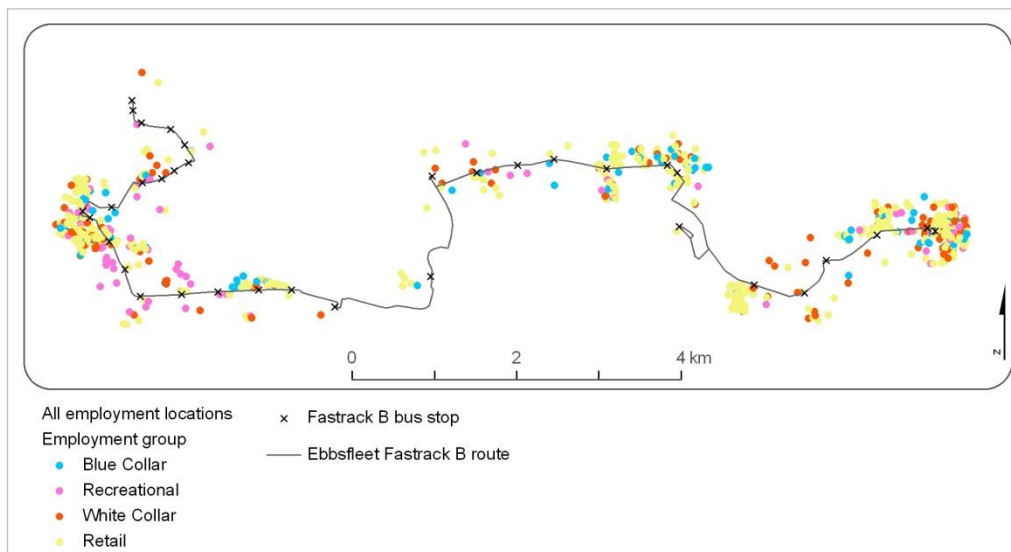


Fig. 7.79: All employment locations within 400m of a bus stop on the Fastrack B route [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey Mastermap2/EDINA Digimap]

Once the cumulative accessibility calculation has been made for each origin bus stop (A_i^x for all employment locations in this first example), the accessibility value is assigned to all the dwellings within 400m of that stop. The values are displayed in four classes from relatively low to relatively high accessibility, seen in fig. 7.80 below.

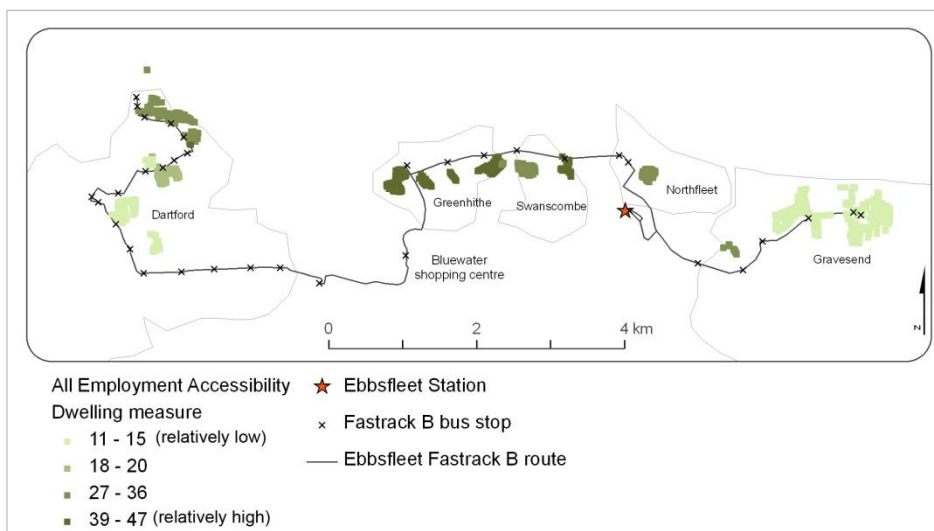


Fig. 7.80: Cumulative accessibility to all employment opportunities along route B [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey Mastermap2 /EDINA Digimap]

This map (fig. 7.80 above) clearly marks out the centre of the bus route (Greenhithe) as benefiting the most from the feeder service in terms of accessing local employment opportunities, with pockets (around Swanscombe) of lower accessibility where the dwellings approach 'walking distance' to the nearest cluster. North of Dartford (to the west) is the secondary area that benefits from the route, whereas Dartford itself benefits the least overall from the introduction of the new MUTP feeder service.

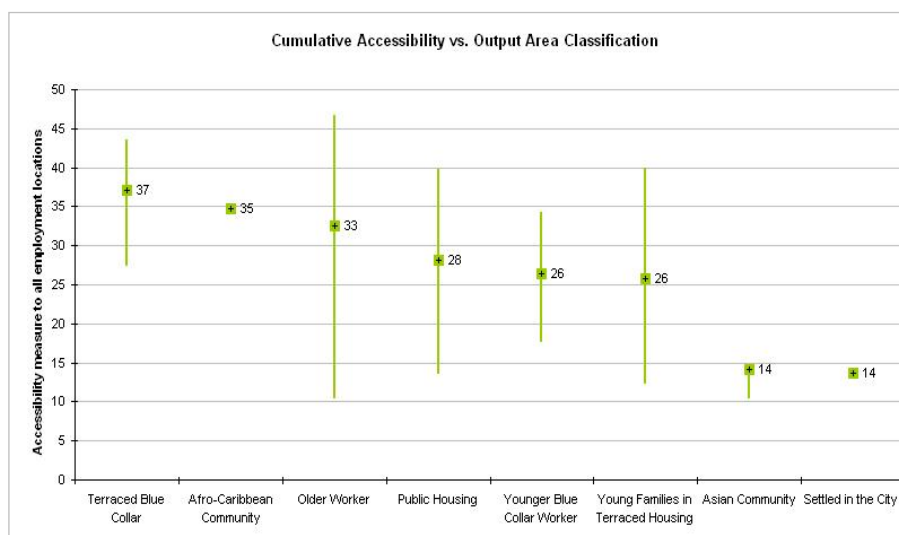


Fig. 7.81: Accessibility measures for the Output Area Classifications: all employment opportunities (full range & mean)

Fig. 7.81 above - and subsequent graphical illustrations of this style - indicate the mean accessibility measure for that OAC group (a small box and a written value), with the full range of accessibility values indicated by a top and bottom 'whisker'. The longer these value 'whiskers' are reflects the greater spatial dispersal of the OAC group along the route. For

example, Older Worker, which often the longest 'whiskers', has several dispersed clusters, whilst Settled in the City, with no 'whiskers', is greatly concentrated in Gravesend.

For the cumulative employment measure, the demographic (as assigned by the OAC) that has their access to employment opportunities most improved is the Terraced Blue Collar Worker class. Although they are the largest classification in terms of numbers of households, the Asian community has the joint least relative accessibility improvement, along with Settled in the City classification. The Older Worker classification has noticeably high and low values as the dwellings in this class are located in both the central area (Greenhithe and Swanscombe) that have the highest accessibility, and Gravesend which benefits the least.

A closer look at what those means (from fig.7.81 above) comprise are broken down by employment type (fig. 7.82 below), and this reveals that there is approximately similar proportions for each type per OA classification, although the middle classifications (Public Housing, Younger Blue Collar and Young Families in Terraced Housing) have moderately varying proportions for 'recreational', and 'blue collar' employment to a lesser extent. This pattern is to be expected, as there are not greatly heterogeneous clusters in differing geographical locations for different employment types.

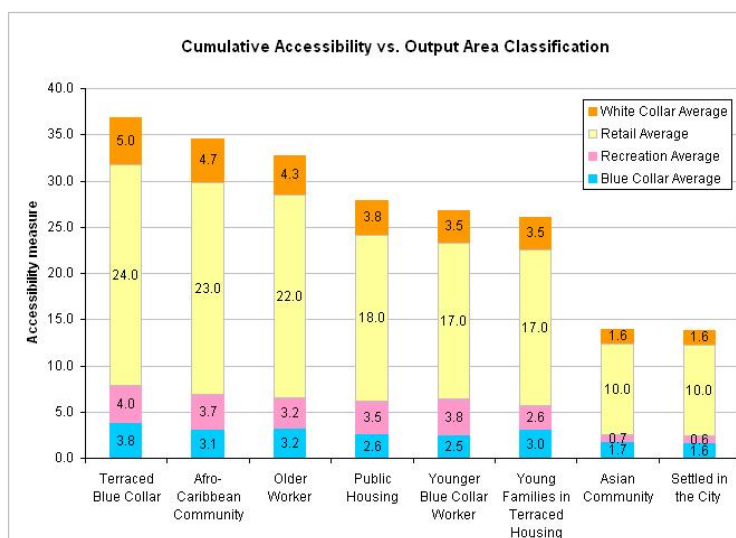


Fig. 7.82: Breakdown of employment types per OA classification

The following sections explore how the employment proportions in the fig. 7.82 are spatially distributed and who benefits most from the new bus service in accessing them. Within this chapter below, accessibility to Blue Collar and White Collar employment locations only are presented, whilst supplementary maps and descriptive statistics for Retail and Recreation employment locations are located in appendix 10.8

Accessibility to 'Blue Collar' employment opportunities (A^{BC}_i)

The demographic groups in the areas with highest unemployment can generally (aside from 'Settled in the City') be deemed approximately 'working class' as this region has a long history of industry and manufacturing, hence this class of employment opportunities is of particular interest. Hairdresser, factory and car dealer are the largest types of employment opportunities in this group, followed by garage, engineering works and depot. Dispersal along the route is still concentrated at Gravesend and Dartford with a further smaller concentration at Northfleet (fig. 7.83 below).

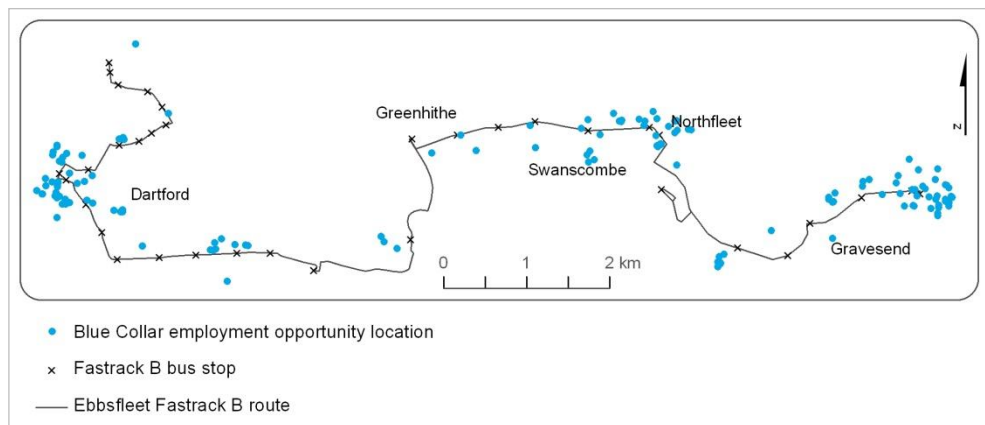


Fig. 7.83: 'Blue Collar' employment opportunity locations along Fastrack B route [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey Mastermap2 /EDINA Digimap]

Increased relative accessibility is again highest for those living in the central area of the route (fig. 7.84 below) and the least relative change for those living within walking distance of Dartford and Gravesend town centres:

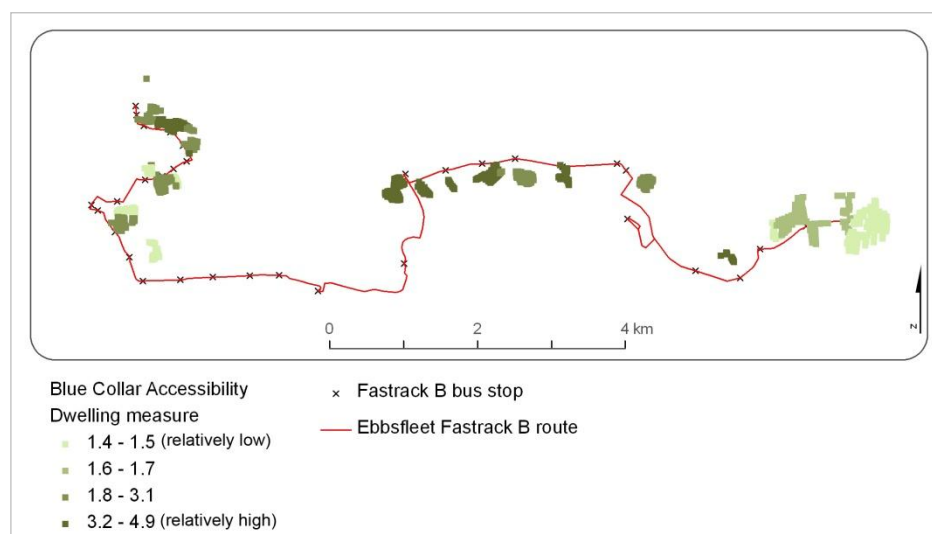


Fig. 7.84: Accessibility for dwellings for Blue Collar employment opportunities [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey Mastermap2 /EDINA Digimap]

Increased relative accessibility brought by this new service is particularly poor for those living south of Dartford. These dwellings are within reasonable walking distance to two areas of blue-collar opportunities and the bus route is not of beneficial use.

Terraced Blue Collar areas have the highest average accessibility, although some dwellings that fall into the Older Worker demographic have higher values, as do Young Families in Terraced Housing (fig. 7.85). As these are key demographics for this type of employment, the bus route is potentially of benefit, provided the service is affordable. The accessibility to this employment type is not greatly improved for those dwellings that are typified as 'Younger Blue Collar Worker', concentrated around northern Dartford, but these are generally within walking distance of the town centre where there are a high number of potential Blue Collar employment locations.

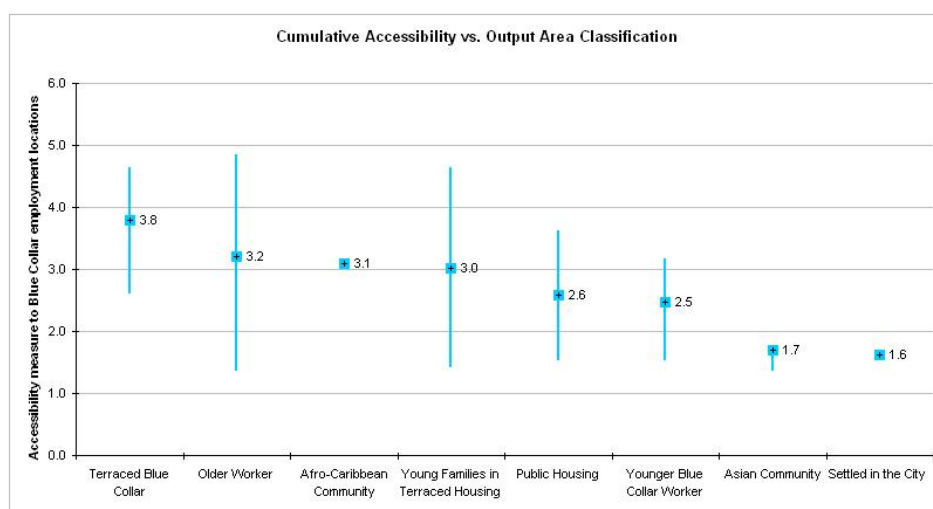


Fig. 7.85: Accessibility measures for the Output Area Classifications: Blue collar opportunities (full range & mean)

White Collar Opportunities (A^{WC}_i)

This employment opportunity type is almost entirely made up of offices with the remainder mostly educational institutions or healthcare. Beyond Gravesend, and Dartford to a lesser extent, the dispersal of this employment is sparse but relatively even along the route:

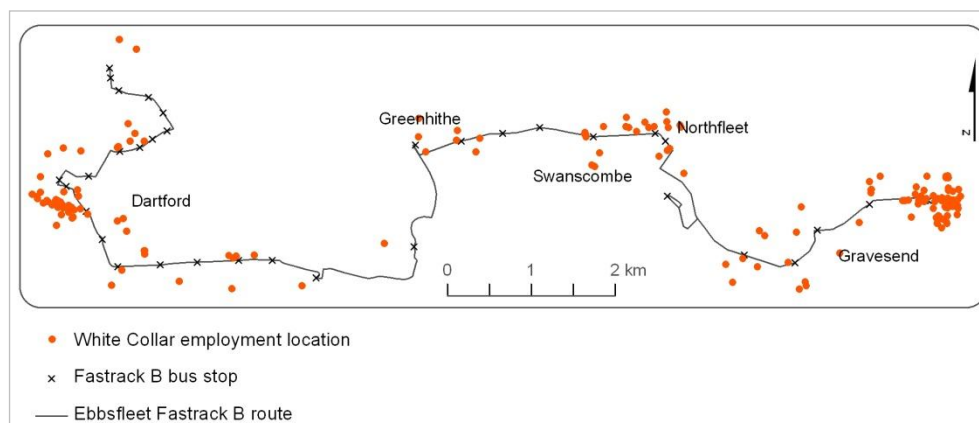


Fig. 7.86: Location of white collar employment opportunities along the Fastrack route B. [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey Mastermap2 /EDINA Digimap]

The accessibility measure map (fig. 7.87 below) illustrates a trend that is similar to other employment locations, with the exception that western Gravesend has no more improved accessibility than eastern Gravesend, and Greenhithe and Swanscombe benefit the greatest.

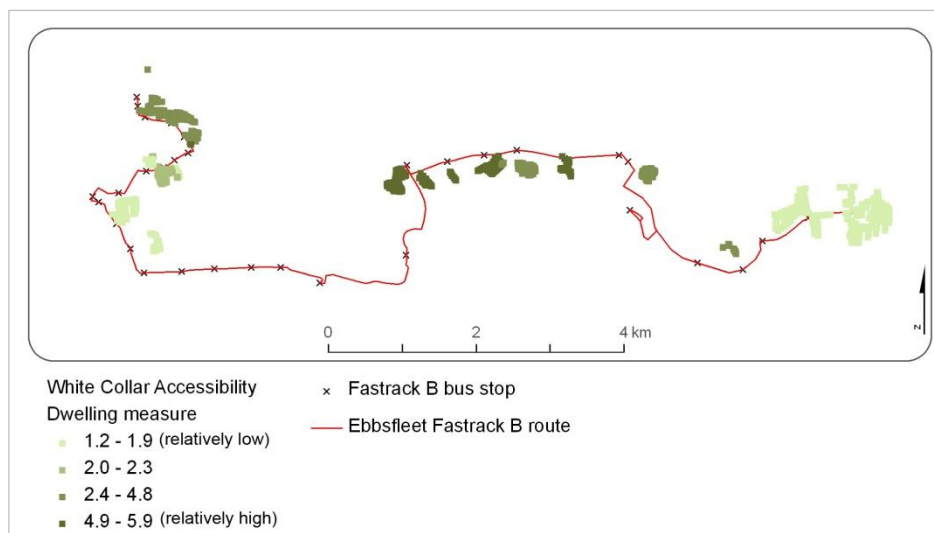


Fig. 7.87: Dwelling measures of accessibility to white collar employment opportunities [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey Mastermap2 /EDINA Digimap]

The demographic type that may most be attracted to white collar employment opportunities are those situated in OAs typified as Settled in the City. Yet they, jointly with Asian Community, benefit the least from the bus route (fig. 7.88 below). This is of course due to their geographical placement within the highest concentration of white collar employment locations, and hence they are able to walk in under 20 minutes to many opportunity locations.

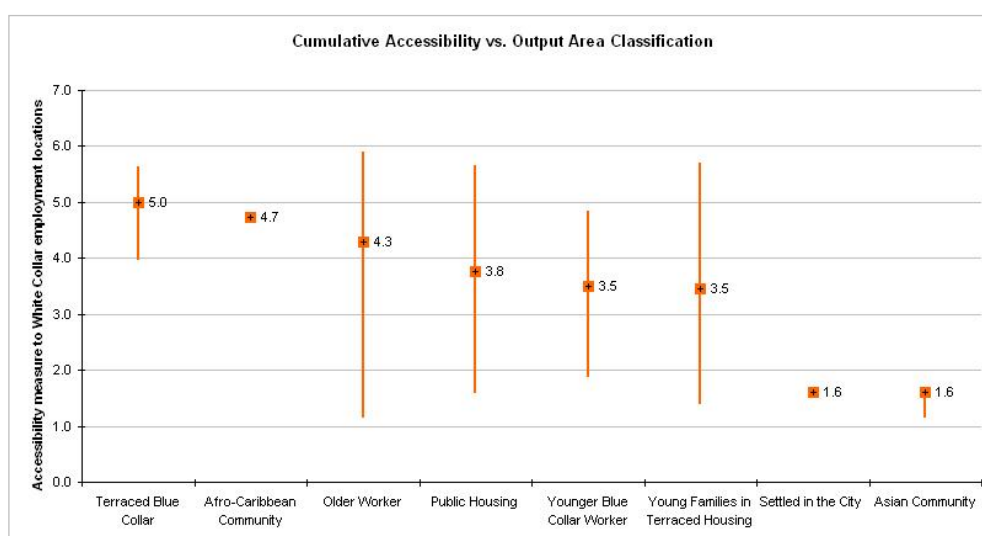


Fig. 7.88: Accessibility measures for the Output Area Classifications: white collar opportunities (full range & mean)

Accessibility from the dwelling locations to Ebbsfleet International station along Fastrack B is included in 10.9

Summary of the Ebbsfleet accessibility measures

OAC group	OAC Name	Accessibility to employment types (rankings)					Mean %		% of population
		Cumulative	Blue Collar	Recreation	Retail	White Collar	Unemployment	TNI	
1a	Terraced Blue Collar	1	1	1	1	1	51	High 2	8
7b	Afro-Caribbean Community	2	3	3	2	2	65	High 1	3
5b	Older Worker	3	2	5	3	3	56	Very high	11
5c	Public Housing	4	5	4	4	4	64	Very high	11
1b	Younger Blue Collar Worker	5	6	2	6	5	52	High 2	8
6c	Young Families in Terraced Housing	6	4	6	5	6	53	High 2	19
7a	Asian Community	7	7	7	7	7	58	High 1	27
2b	Settled in the City	8	8	8	8	7	56	Average	14

Fig. 7.89: The Ebbsfleet accessibility measure results matrix

Summarising all the pertinent data in a matrix such as fig. 7.89 (above) allows planners and decision-makers to assimilate where, and for whom the feeder service brings the highest relative accessibility improvement over existing bus routes or walking. The OAC groups are ranked in order of which group benefited relatively the most to least (based on fig. 7.82). The addition of supplementary information regarding mean percentage of OA unemployment and Transport Need Index (TNI) values contributes to the understanding of who are the relative winners and losers of the feeder service in terms of accessing more potential job opportunity locations.

The Terraced Blue Collar Work class, with lower 'high public transport needs', the lowest mean unemployment level and is the second smallest proportion of the Fastrack B potential ridership population, ranks first in all the measures. The smallest demographic group represented on the route, Afro-Caribbean, is ranked second and has an upper high transport needs index value and the highest mean unemployment level. A demographic group with typically very high public transport needs, and the second highest mean unemployment level is the 'Public Housing' class, who rank 4th overall (5th for changes in accessibility to Blue Collar opportunity locations). Some pockets of this dispersed demographic group fare much better than this, for example in northern Dartford. The demographic that received less improvement to their accessibility to employment locations was the Settled in the City class, located wholly in central Gravesend with average transport needs and a medium-level mean unemployment value.

7.3c

The Accessibility indicator: Findings & critical assessment

Accessibility indicator aim

The aim of this indicator was to ascertain if even with relatively limited demographic data, an accessibility measure can capture the relative concentrations of those in the local community, constrained by socio-economic circumstances, who rely heavily upon public transport (namely bus trips). This would enable MUTP-related transport planning to optimise routes so as to benefit both the MUTP commuters and those requiring affordable access to local facilities and job opportunities.

Ashford accessibility indicator

In Ashford, the OAC in its unadulterated format did indicate that some census groups have an above national average response to using public transport in order to get to work. Groups 2b (Settled in the City) and 5c (Public Housing) are groups that are typically located in relatively high density urban centres as seen in the case study hubs. Amending the demographic typology to that of the Transport Needs Index methodology enabled the analysis of the SmartLink bus route to capture where the higher proportion of the population with public transport needs lived that could potentially be served with the proposed route. Also maps were produced that illustrated the areas where high transport need was postulated but the new SmartLink service was beyond a five minute walk, reducing the likelihood of their patronage. Finally the GIS enabled the integration of the SmartLink bus route buffer and the LSOAs of highest relative deprivation that were declining further in rankings (a proxy for entrenched deprivation). There were such areas that were beyond the route's 400m buffer and therefore may not be benefiting from the service. Although SmartLink is only one of many bus routes serving the 3km urban analysis zone of Ashford, it would seem from this indicator that the needs of those with high public transport needs as well as the potential CTRL users are being met in the current phase one of the service. The GIS maps demonstrate this adequately and the aim of the indicator is achieved. With regards to phase 2 (see fig. 7.66), the route is proposed to extend into as yet unconstructed new housing areas, which will quite likely contain residents who are interested in using the CTRL to commute (see the promotional literature: Ashford Best Placed (2008)). A feeder service could encourage them away from accessing Ashford station by car. However the route extension does bypass those OAs with populations that typically have very high (public) transport needs in the south of Ashford. Therefore the second phase of the service has a more specific patronage (potential MUTP users), and much less relatively accessibility

increase for those most in need (less likely to be MUTP-users). This is not to presume that other routes already running on the network are not meeting their needs.

Ebbsfleet accessibility indicator

A more conventional gravity-based potential accessibility model was carried out for the Fastrack B feeder service in Ebbsfleet. For this measure the OAC groups were used for the more familiar origin-destination matrix-based study, since the measure was considering the opportunities of offering greater relative accessibility for people to 'suitable' job opportunities. For example, did the population living in typically blue-collar areas (OAC groups 1a and 1b in the study) have relatively increased accessibility to 'blue collar' job opportunity locations along the Fastrack B route? In figs. 7.85, and 7.88 there were mixed results. Regarding Blue Collar job opportunity locations, the most improved accessibility was for Terraced Blue Collar Worker, yet Younger Blue Collar Worker were afforded much less relative improvement to accessibility than most of the other OAC group dwellings. Also the Asian Community and Settled in the City classed OAs fared worst of all the demographic groups as they benefited the least from the accessibility offered by the bus service. This was due to living within walking distance to concentrations of job opportunities in Dartford, and in this case, the Fastrack B bus service did not improve their already relatively good accessibility for employment. The use of the Output Area Classification (OAC) typology in the measure, and the 'summary results matrix' for considering who was benefiting from the changes in relative accessibility to what types of employment opportunities, was advantageous. This was generally more revealing (ecological fallacy issues notwithstanding) about the requirements of the householders along the route than simply the level of unemployment alone. Regarding the aim of the indicator, with the Ebbsfleet measure the aim is also achieved as decision-makers and planners can explore the non-MUTP user ridership needs. The indicator established the location of different unemployment levels and demographic characteristics of the route's population, therefore setting the pricing and bus stop locations to maximise social equity is possible.

Technical and conceptual critique of the indicator

Of course introducing a Bus Rapid Transit feeder service is only accessible to those relatively more deprived if it is affordable. Although it is not possible in this case-study to model income at household level resolution to incorporate into the accessibility measure, it goes without saying that dwellings identified in the indicator as having high levels of accessibility, cannot tap into the potential benefits of the service if the bus service fares are set too highly. As of April 2011 the cheapest adult fare is £1.80 (single within the same travel zone / £2.80 return) and most expensive is £4.70 (return between three adjacent travel zones) (Fastrack 2011). Each potentially working adult would need to consider these costs against car / petrol / parking costs (or cost and speed vs. cycling and walking). There is clearly a greater friction to travelling further than simply linear time (in the current measure)

and including the change between zones would alter the accessibility levels as is currently measured.

The Journey to Work indicator (chapter 7.5 below) highlights the differences within the hubs between the most and least deprived wards in the 10km zones regarding the distances travelled to work. The relatively least deprived travelled the furthest whilst those in areas of relatively higher deprivation travelled mostly locally, under 10km (an area served by the bus network). Therefore the increased accessibility potentially on offer by a BRT feeder service is of interest to those using buses as their main mode to localised job markets as well as MUTP users, drawing both away from ever increasing car use for the commute.

An increase of accessibility in the bus network can also aid towards offsetting the impediments to accessing local facilities that the Physical Barriers indicator (chapter 7.4 below) recognised. The line haul is a significant architectural impasse in many places but an affordable BRT option can offer the chance to access services relatively quickly.

In Ashford, knowledge of both the SmartLink bus stop and dwelling locations would have resulted in a more accurate assessment of who would be likely to receive the additional accessibility benefits. However the 400m buffers (either for the stop or the route) is an artificial boundary that may well not conform to resident's pattern of behaviour relevant to the data sampling in both Ashford and Ebbsfleet. I often walk nearly 10 minutes to access a bus stop for a route that has a more beneficial destination and shorter travel times than nearer bus stops, and no doubt this is a common strategy employed by many people. Hence the 400m buffer excludes an unknowable proportion of potential riders who have high (public) transport needs. Possibly having a secondary buffer of up to 800m (10 minutes walking time for average level of mobility) would produce a supplementary potential ridership.

Assessing a bus route in isolation also makes it hard to assess the importance of that route to access not only the MUTP (here the CTRL stations) but also other bus routes. Switching at major interchanges is a reality of using the bus network for many users. Hence considering the additional accessibility brought by one route alone hides another accessibility benefit of extending the catchment area of the entire bus network, extrapolating the accessibility in many spatial directions. A measure that incorporates all the modes, such as Transport for London's Public Transport Accessibility Level (PTAL) measure, or extraction from the online National Public Transport Data Repository would help to explore the increase in network density when new feeder route is introduced.

With regards to the classification of employment opportunity types in the Ebbsfleet measure, one improvement would be removal of the 'General Commercial' class from the analysis of Retail employment opportunities (in appendix 10.8). It represented poor/unlikely job

prospects yet dominated the number of potential employment locations. However there was not a great distinction of accessibility between other groups of employment locations between OAC types, aside from Asian Community and Settled in City as discussed above (see fig. 7.82 for clarification).

Future guidelines for planners and decision-makers

From this indicator, planners and decision-makers can gain a comprehension of the demographic type, unemployment levels and public transport needs of the people who are potentially able to utilise a bus route. This enriches an accessibility measure that can incorporate the requirements of the patrons, and places the attractiveness of the destinations (either in terms of potential employment or general facilities and services) in a firmer socio-economic context.

Lessons learnt for planners decision-makers

Both the Ashford SmartLink and Ebbsfleet Fastrack BRT feeder services do not preferentially serve the requirements of those in most need of affordable public transport, as the routes undoubtedly service many sectors of the population not least the MUP-users. Nonetheless, those identified as being in most need (high unemployment, high social exclusion and other demographic characteristics) are partially within reach of the routes. The relative adaptability of a bus route over a tram or light rail enables planners to potentially consider future amendments that fulfil those needs. Any such amendments would be fairly predictable as the process of improving accessibility could be viewed as a 'known' processes, hence standard operating procedures from previous experience can be applied and a relatively stable outcome can be expected. As per the preceding Deprivation indicator, the *Cynefin* framework suggests a management strategy of 'sense-analyse-respond' for outcomes of changes to accessibility levels, and scenario planning is a useful tool.

7.4a

The Physical Barriers indicator:

Methodology

This impact indicator aims to draw attention to the issues the physical infrastructure of a railway line can bring to a community. Such a linear barrier can:

1. Blight an area visually and through noise
2. Divide an existing community or neighbourhood
3. Increase the spatial confinement of an area, increasing the risk of continued poverty to the most vulnerable
4. Provide a form of segregation between populations of different socio-economic status
5. Impede local access to facilities through a reduction in local 'permeability'

These are arguably the most significant direct causal effects upon the hubs, but as they incorporate datasets from preceding indicators, they are approached belatedly. The decision to locate a railway alignment is highly complex, touching upon local to national political, environmental, engineering and financial considerations (Omega Centre 2011). The issues presented by the sub-indicators do not presume to override these; nonetheless these are important issues to the populations at the hubs. They are considered 'severance'-related issues in an MUDP appraisal, potentially non-quantifiable factors that are still absent in reality from most MUDP appraisals (C.f.I.T. 2004: A1.23) until very recently (Atkins 2010).

Potential benefit for the MUDP appraisal

As there are negative connotations to these sub-indicators, planners and decision-makers can instead demonstrate an awareness of the potential risks in the hubs and formulate a management strategy for mitigating against such negative effects if appropriate.

Aim of the indicator

An indicator such as this could help planners identify if there are areas at risk of physical and social marginalisation, or a general decrease in the standard of living due to the MUDP and its associated infrastructure.

Objectives

- To digitise the main CTRL line haul, additional railway lines, rivers and motorways that occur around and within the case-study hubs, to represent potential significant physical barriers
- To overlay and explore these possible barriers with further datasets such as deprivation, demographic profiles and crime statistics. This is to assess the potential link between areas of relatively low standard of living (high multiple deprivation

including income and employment deprivation, high crime rates and lower socio-economic class) and second-order effects of the MUP and its infrastructure

- To assess the value of using higher spatial resolution data with the inclusion the locations of dwellings and facilities in Ebbsfleet to consider the differences in clarification in responding to the indicator aims

Method

Below are four final sub-indicators for the Physical Barriers indicator with related research questions. Regarding a noise or visual blight related sub-indicator, whilst undoubtedly a significant issue, these environmental impacts are covered within the planning and appraisal of the CTRL under the Environmental Statement and Environmental Minimum Requirements of the CTRL Act 1996. It is not the focus of this research to conduct an environmental impact study, which employs well-known and used indicators.

The Neighbourhood Division sub-indicator:

Does the railway line separate members of a neighbourhood?

Boundaries of a 'neighbourhood' are highly subjective. This is a cognitive concept rather than anything physical (Rapoport 1977, Cohen 1985) and hence it cannot be simply mapped from general-release digital data. Jenks and Dempsey (2007:154-5) carried out work relating to socio-spatial delineation of neighbourhoods, defined as largely residential and urban, with a mix of functional, physical and social elements defined by the occupants. They cite Campari (1996) who suggests that there are a variety of proponents to how one might view the extent of their neighbourhood, including historical patterns, physical features, religious discretisation and local usages (Jenks and Dempsey 2007:163).

Given the variety of boundaries that residents have demarcated in the figure below (7.90), one can see that it is extremely difficult for a non-resident to capture the fuzzy edges of such a space. The authors conclude that Output Area + a buffer of 400m and a mix of residential and mixed/used space bounded by a significant natural feature and/or large transport infrastructure feature (such as major road or railway) could be a suitable basis (Jenks and Dempsey 2007:172-3).

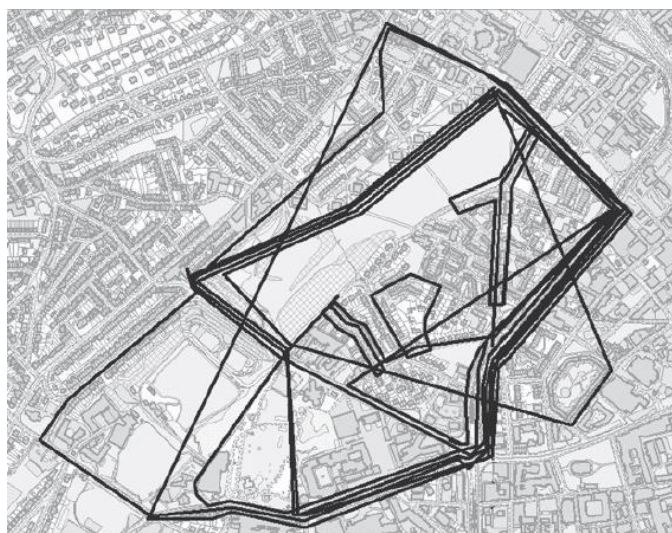


Fig. 7.90: Residents defining boundaries of their perceived 'neighbourhood' in Oxford or Sheffield (Jenks and Dempsey 2007:169).

With this in mind, the impact indicator utilises the 3D rendering capabilities of the ESRI 'ArcScene' programme to exaggerate the barrier-like qualities of the CTRL line haul, other local railways (in operation before the CTRL) and local motorways, derived from the Integrated Transport Network data from Digimap. There are gaps in the barriers where bridges or underpasses enable traversing in both Ashford and Ebbsfleet. These overlay the OAC demographic dataset, using the OAC typology as a proxy for a community. This proposes that a population within an Output Area (c150 households) that share socio-economic and dwelling type traits roughly approximates a community. Working with 400m buffers around each OA (as Jenks and Dempsey 2007 above) proved to be visually confusing. Better contextual knowledge of the area as understood by a local planner would enrich this approach, and give this impact indicator a more powerful meaning in practice (Rae 2009:1861).

The Spatial Confinement sub-indicator:

Are areas of entrenched multiple deprivation made 'worse' by spatial confinement following the construction of a railway line, as living in a 'bad area' (e.g. high deprivation and crime rates, poor health and low quality of housing) exacerbates vulnerability to poverty?

To explore this issue at the hubs, a map is created that identifies where areas that are most relatively confined are located after the construction of the CTRL, for both Ebbsfleet and Ashford. These relatively more confined areas are delimited by falling between two or more major barriers (other railway lines or a motorway for example). The maximum distance between barriers to form these partially or fully enclosed spaces is restricted to around 1km. This map is rendered partially translucent with an aperture for the new relatively confined space and is displayed over the OAC groups, so a quick but effective indication of which demographic groups are impacted by the introduction of the railway line haul. The Index of Multiple Deprivation maps from chapter 7.2b are also examined in this context to visualise

areas that are newly confined (relatively) by the MUDP and furthermore are ranked as relatively deprived in the hub. Crime rate statistics from the Kent County Police website are the final socio-economic dataset explored to understand if these relatively confined areas are experiencing higher crime rates than average between 2007 and 2008 (post CTRL implementation). The use of Space Syntax Analysis could also be of help to examine the 'axial depth' changes in the permeability between neighbourhoods after the introduction of the railway line, and is discussed further in the findings section for this indicator.

The Community Segregation sub-indicator:

Are the populations expected to occupy the new MUDP-related developments of significant socio-economic contrast to existing populations that a physical barrier would be of benefit?

This sub-indicator follows on from the research of Billig and Churchman (2003) regarding the subtle but effective segregation of populations of largely differing social classes (chapter 2.2). In Ebbsfleet, the marketing literature for the Ebbsfleet Valley development is aimed at a demographic typified by commuters, young middle class couples and families for the new mixed development around the CTRL station [www.ebbsfleetvalley.com]. The c10,000 new households (c30,000 new residents) on c1,035ha of land planned for the development is a sizable immigration to this area relative to the sizes of immediately surrounding small towns of Greenhithe (2009 population estimate 5,740), Swanscombe (2009 population estimate 7,280) and Northfleet (2009 population estimate 15,910) (Kent County Council 2010). How well can these new residents interact in public spaces with the existing local residents, and does the CTRL line haul provide the kind of physical boundary that both populations may find beneficial? The GIS impact indicator highlights the boundary of the new development and utilising the above 3D rendering of the physical barriers, notes where old and new meet and the separation (or lack of) between them. This impact indicator is a significant element of the Community Cohesion meta theme indicator in chapter 8.2.

The Impeded Access to local facilities sub-indicator:

Is there decreasing accessibility to local facilities following the construction of the MUDP?

Literature regarding the change in accessibility of a railway line generally focuses upon the potential increase in accessibility the users of the railway can experience, rather than the decrease of accessibility to local facilities faced by users and/or non-users of the railway in circumnavigating this new barrier.



Fig. 7.91: Ebbsfleet station, line haul and 9000-place car park 2006. Looking northwards towards the Thames and Swanscombe Peninsular (©Google Earth 2006)

Severance issues in communities are discussed in chapter 2.2, as are mitigation measures including improving access under, over or across transport infrastructure (see the extent of the car parking for Ebbsfleet station in fig. 7.91 above). These aim to reduce trip lengths or time and improve safety and neighbourhood integration following the construction of a new road or railway line. A recent severance mitigation measure was a footbridge across the M20 in Ashford (May 2011).



Fig. 7.92: Ashford M20 pedestrian & cyclist bridge (©Ashford Futures website May 2011)

The new suspension bridge (fig. 7.92) provides much improved pedestrian access between the urban centre of Ashford, peripheral communities such as Kennington and the Eureka Leisure Park, that were previously accessible via a dangerous, poorly lit crossing (Ashford Town Talk 2011). In contrast, the refusal to grant a much needed (and campaigned for) replacement pedestrian bridge over the railway lines around Kings Cross / St Pancras, despite its inclusion within the project's section 106 conditions, has caused considerable frustration to the local community. The Eastern Range / Platform Zero refurbishment has resulted in long detours for local Camden and Islington residents wishing to avoid the busy station entrance to travel east-west (Talbot 2010).

An exploration of the changes in relative 'spatial permeability' could indicate where there had once been ease of access by car, as well as bike or walking for example, the railway line had created a situation where a longer journey by car was the only viable mode. Utilising the attribute data from OS MasterMap Address Layer 2, available only for Ebbsfleet, subsets are extracted of dwelling and local services within 1km of the line haul. A 'Nearest Neighbour' (Euclidean distance rather than road network distance) measure is then generated. These facilities are broadly grouped into recreational locations (bar, restaurants, cafés etc and sports facilities), retail locations (general commercial, shopping centres, supermarkets and the occasional garden centre), and health & education locations (schools, nurseries, clinics, surgeries and dentists (there are no hospitals in the 10km analysis zone)). The latter group is explored more closely for clinics and surgeries as these can be usually considered of a high priority for ease of access for the local population. It also forms part of the D.F.T.'s Core National Indicators for accessibility targets (NI 175: percentage of households or households without access to a car within 15 and 30 minutes of a GP by public transport). The map output then focuses upon instances where the nearest neighbour path between a dwelling and nearest facility is across the railway line, indicating areas that could benefit from extra crossings for pedestrians and cyclists.

Future guidelines for planners and decision-makers

This indicator will enable planners to formulate context-specific evaluations of areas that appear to have decreased standard of living and to alleviate situations that as a direct or indirect result of the MUDP infrastructure contribute to entrenched deprivation and/or high crime rates.

Lessons Learnt for planners & decision-makers

The Impeded Access sub-indicator is proposed to be a process in the 'known' domain of decision-making as discussed in the Accessibility Measure indicator above (chapter 7.3). Community Segregation can be considered a 'knowable' process; where the positive and negative effects of creating subtle segregation and differentiated public spaces between existing neighbourhoods and ones that are created and populated rapidly could be perceived in the long term, and the design of which could contribute to good practice guidelines for further new developments in the area if appropriate.

Neighbourhood Division and Spatial Confinement are 'complex' processes due to being so subjective, hence the impact of these could be difficult to quantify and summarise for future considerations of these issues. Future applications of this indicator could incorporate the views of local people to clarify the effect of the line haul. However this is not to detract from the enrichment of knowledge planners could gain from identifying areas potentially at risk, monitoring and intervening if that was considered suitable.

Cross-influence with meta themes

The relative impermeability of a railway line (and other major transport infrastructure) could impact upon Community Cohesion. The Community Cohesion indicator includes the Neighbourhood Division and Community Segregation sub-indicators. The fragmentation of an existing neighbourhood can have negative effects, disrupting the socio-cultural dynamics and the use of space that make the community feel cohesive. Lack of segregation between the old and new populations of significantly differing social status can lead to resentment and tension also possibly reducing cohesion.

The Impeded Access sub-indicator forms one of five data inputs for the Social Exclusion indicator in chapter 8.2, whereby the reduction in access to facilities here can be reinterpreted as impediment to new job opportunity locations and is included alongside other accessibility-based measures.

7.4b

The Physical Barriers indicator: Input data and output maps

The Neighbourhood Division sub-indicator

Ashford

The first of four impact sub-indicators associated with the effects of the MUDP infrastructure is the division of an existing community. As noted in the previous section (7.4a) this seeks to visualise where neighbourhoods have been ostensibly separated by the infrastructure of the MUDP, with the OAC typology acting as a proxy for the neighbourhood. This currently focuses upon the urbanised areas of the zones, as relatively sparsely populated rural areas do not conform to the notion of a divided neighbourhood in the same way as an urban community.

Railway lines have bisected Ashford to some degree for a long time; Ashford station itself opened in December 1842, with a line northwards to Maidstone since 1884, westwards to Redhill since 1842, southwards to Folkestone since 1843 and eastwards to Canterbury since 1846 (Rutter 2007). Nonetheless this high-speed rail link has its own dedicated track and therefore an additional infrastructure alignment through the town.

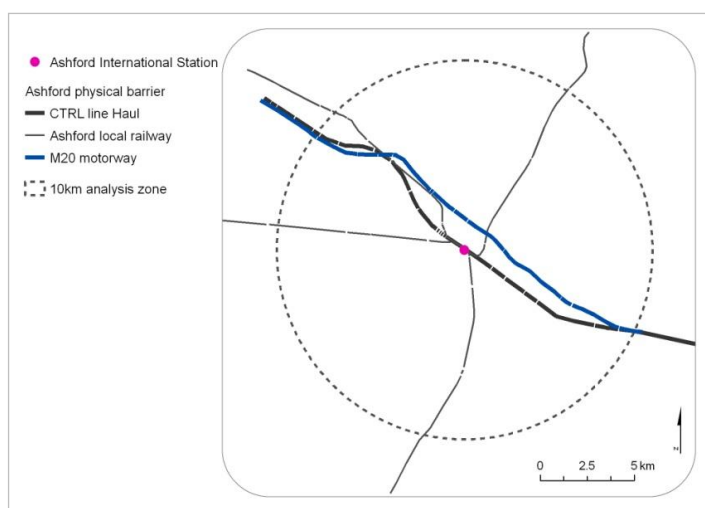


Fig. 7.93 Ashford: Physical Barriers key to 3D maps ([Integrated Transport Network datasets ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap])

The above illustration (fig. 7.93) provides the key to the ArcScene 3D rendered maps (figs. 7.94 & 7.95 below) that explore the barrier-like qualities of the railways and motorway, although the focus is primarily upon in the CTRL (depicted in a thicker black line). Note that scale and orientation are not able to be provided on the 3D maps, nevertheless the rendering, with gaps for the road crossings, is illuminating.

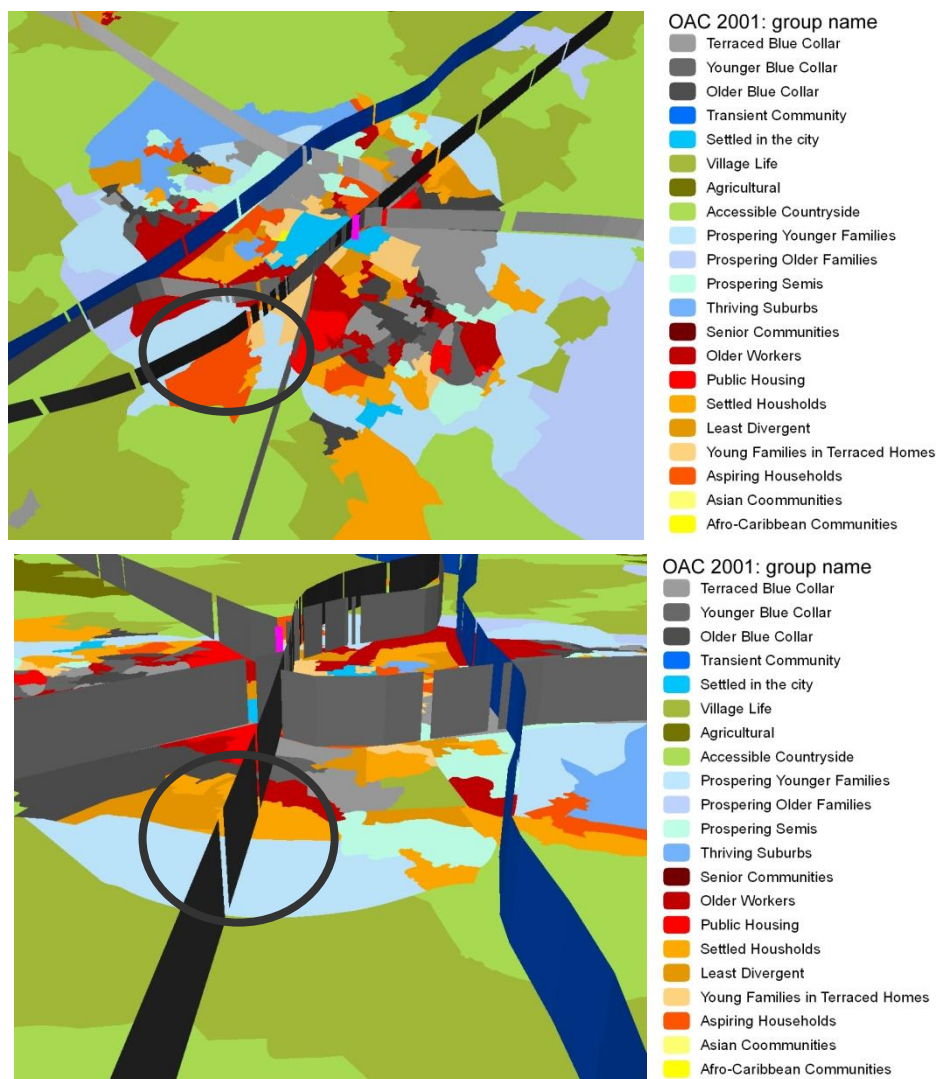


Fig. 7.94: Ashford barriers over the 2001 OAC Groups (west) & Fig. 7.95: Ashford barriers over the 2001 OAC Groups (south-east) [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

Major infrastructure features, such as those noted here, are often used as boundaries for census units. Therefore there is some evidence in the figures above of digitisation artefacts that have led to discrepancies in the boundaries of the OAC, and the railways or motorway that do not indicate a true division of a neighbourhood. There is some segregation between OAC typology groups where the CTRL alone - not when in the same shared space as the other, more historic, railway alignments - has split a group. Fig. 7.94 above illustrates that the CTRL acts to divide demographic groups, circled in dark grey: Aspiring Households (red-orange), and Prospering Younger Families (light blue). Circled in fig. 7.95, Settled Households (mid-orange) and Prospering Younger Families (grey-blue) exist on both sides of the line. There are few passes evident in the line haul indicating that road traffic and pedestrians have limited opportunities to cross this barrier locally.

Ebbsfleet

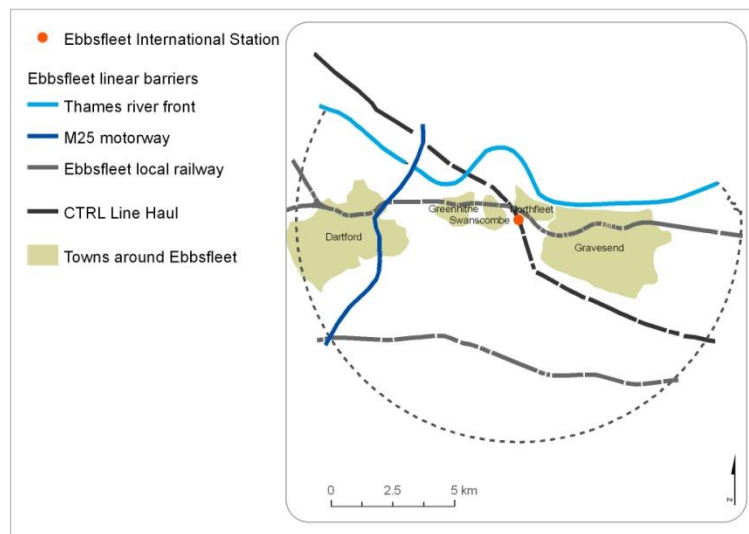


Fig. 7.96: Ebbsfleet: Physical Barriers key to 3D maps [Integrated Transport Network datasets ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The two closest established communities to the Ebbsfleet Valley MUDP-associated development are Northfleet to the northeast and Swanscombe to the northwest. The North Kent railway network, in use since the 1840s, already bisects these (Rutter 2007), as do the chalk and clay pits in the area since the early 19th century [www.swanscombe.com/history]. Above, fig. 7.96 provides the infrastructure key to figs. 7.97 and 7.98 below.

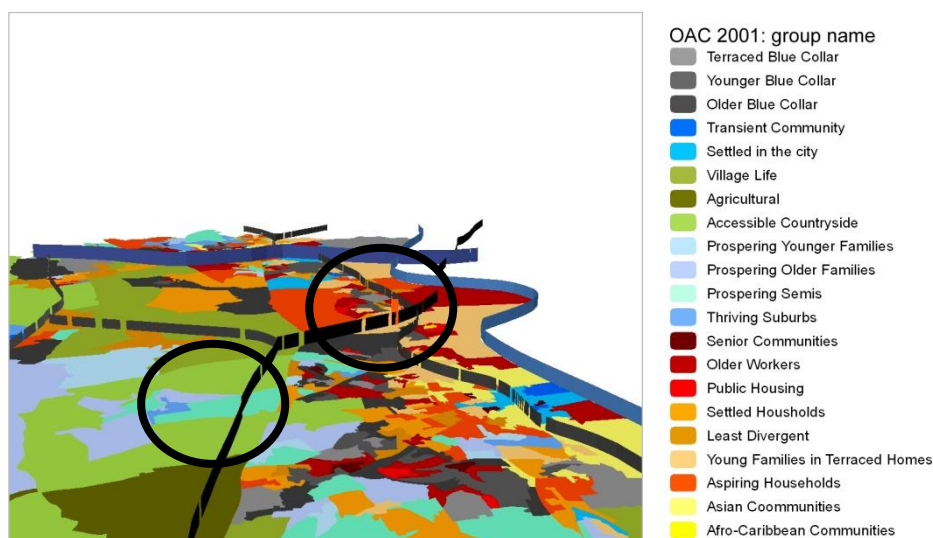


Fig. 7.97: Ebbsfleet barriers over the 2001 OAC Groups (south-east) [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

Here, as is so often the case, local knowledge is vital in interpreting these maps accurately. In fig. 7.97, the CTRL seems to divide some of the suburban 'Prospering Semis' group in turquoise (in the foreground).

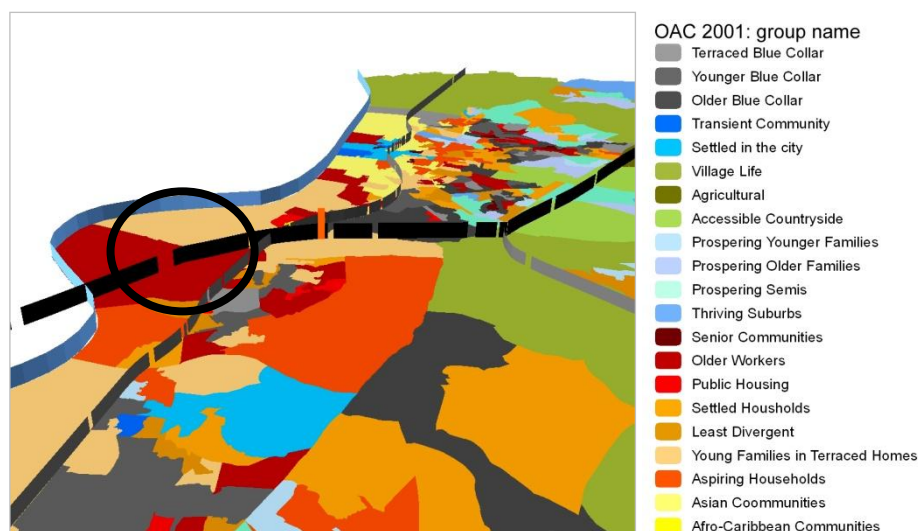


Fig. 7.98: Ebbsfleet barriers over the 2001 OAC Groups (north) [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

Yet like much of this sparsely populated area, the Output Area boundaries form a continuous surface and in fact, the vast majority of the population live away from the railway (and the A20 trunk road not depicted). Also in fig. 7.97 round the station (orange marker) an area of Young Families in Terraced Housing (pale orange) could be divided but this area, the Swanscombe Peninsular, is barely inhabited north of the local north Kent railway line. Hence this OAC-based proxy for neighbourhood remains relatively unaffected. Similarly in the second image (fig. 7.98) the CTRL transects a large dark red OA (Older Workers).

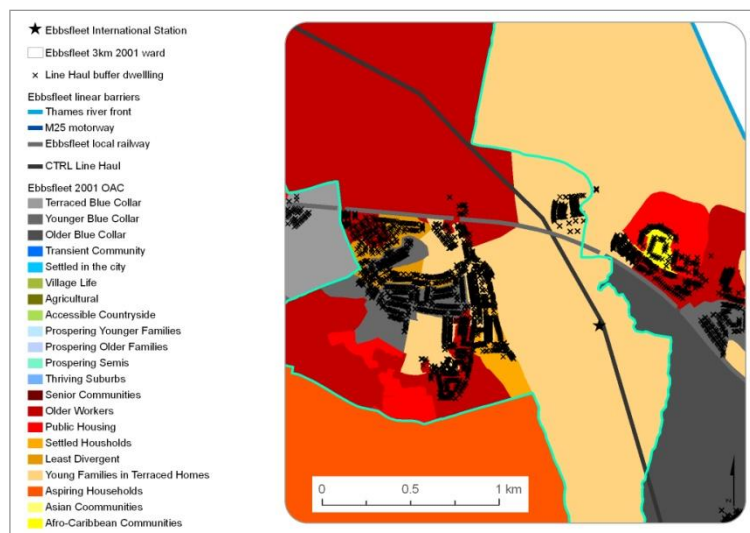


Fig. 7.99 Ebbsfleet barriers over the 2001 OAC Groups and dwelling points [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

Once the MasterMap dwelling locations are plotted (fig. 7.99 above), once can see that in fact this area sparsely inhabited and possibly less likely to be a 'divided' neighbourhood. In

both of the case study hubs, discussions with the residents of the areas bordering the CTRL line haul would ascertain the veracity of these assumptions.

The Spatial Confinement sub-indicator

With the aim of producing a rapid and intuitive guide regarding the change in spatial confinement for urban areas, polygons were created to illustrate an approximate space where there is a difference in the 'permeability' of the landscape due to this new barrier passing through. The conditions for the containment polygon creation was that the difference in the confinement of a space post-MUTP construction was either a total enclosure of an area under 2km (at the narrowest width) or has the largest distance between two non-enclosing barriers (in this case study the CTRL and another physical barrier such as a motorway, river front or other railway lines) not exceeding 1km. This is an arbitrary distance, and could be further refined in future work by assessing, for example, the details of the infrastructure's porosity such as numbers and spacing of passes (e.g. car/foot bridges, underpasses). Also reviewing the urban form either side of the barrier may be useful as the decrease in accessibility or mobility will be closely tied to pre-MUTP land use. 1km suffices for the purposes of illustrating the uses of this approach to indicate relative spatial confinement.

Ashford

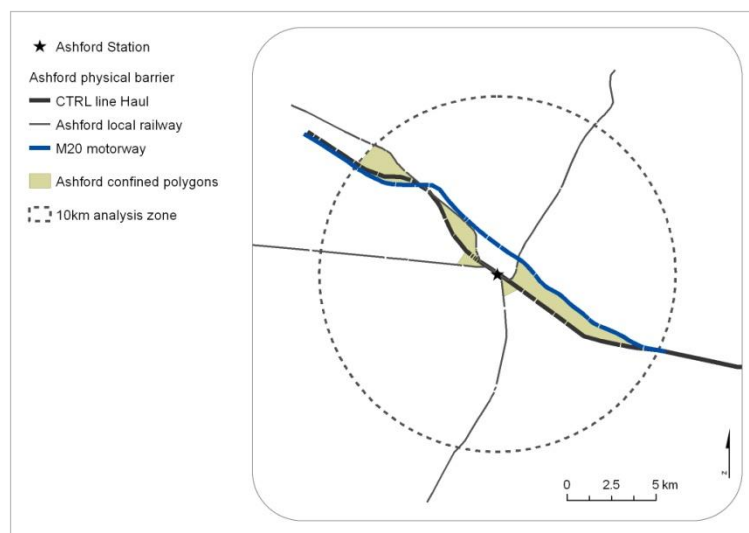


Fig. 7.100 Ashford measure of spatial confinement: confinement polygons

In Ashford there are five main spaces, and two minor that are relatively more confined since the construction of the MUTP, due to the proximity of the CTRL line lying close to previous railway alignments and the M20 motorway. Between these barriers the confined spaces are depicted in green in fig. 7.100 above. This is not to say that the barrier has not impacted the areas immediately beyond the polygons, but this indicator seeks to identify the relative enclosing of urban space. Extracting the confinement polygons from the 10km analysis zone

polygon leaves a 'cut-out' aperture of the confined space, through which other socio-economic data can be viewed.

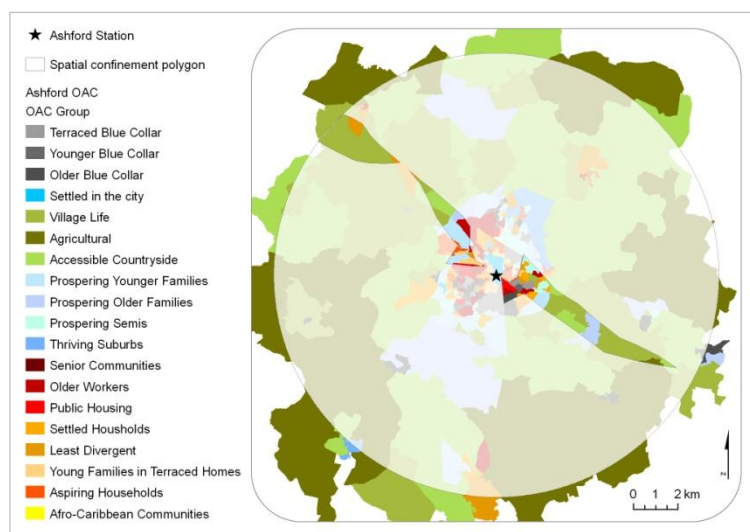


Fig. 7.101 Ashford measure of spatial confinement: confined areas aperture and 2001 OAC (Groups) [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

The map above (fig. 7.101) indicates the demographic groups that are within the new relatively confined spaces in Ashford (a combined area of c1520ha), following the construction of the CTRL. Much of it is rural; Accessible Countryside and Village Life, with an Output Area of Prospering Older Families contained to the south-east. A close-up of the main 3km core zone of Ashford below (fig. 7.102), demonstrates that there is a range of demographic groups impacted. In fact most groups present in the 3km analysis zone are represented, with no one group dominating.

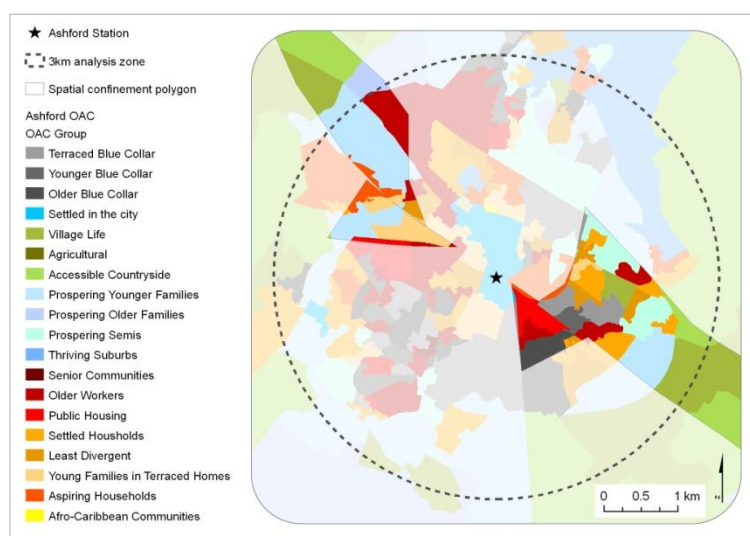


Fig. 7.102: Ashford measure of spatial confinement: confined areas aperture and 2001 OAC (Groups) (close up of the 3km zone) [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

Viewing the Index of Multiple Deprivation (IMD) rank changes for the most deprived quintile of Lower Super Output Areas (LSOAs) in Ashford (fig. 7.103 below) reveals that the newly confined spaces include the most deprived quintile.

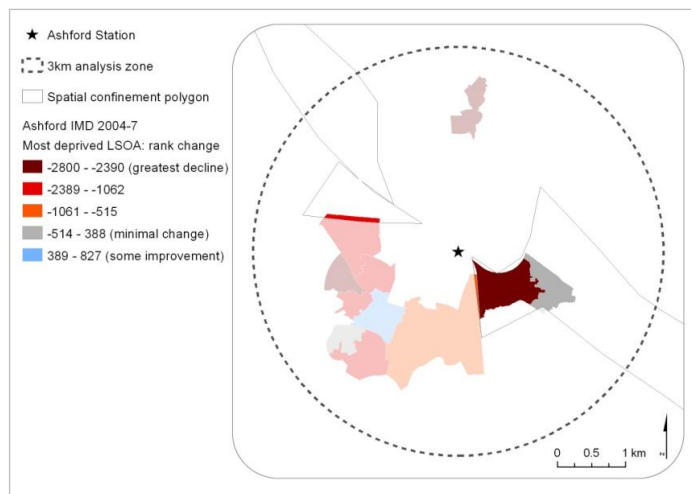


Fig. 7.103: Ashford measure of spatial confinement: confined areas and Index of Multiple Deprivation (rank changes between 2004-07, most deprived Lower Super Output Areas in the 3km zone) [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

This LSOA corresponds to the Public Housing and Blue Collar demographic in the south east of the preceding map (fig. 7.102), which has fallen in rank between 2004 and 2007. This timescale does not correlate with the construction of the CTRL line haul (this alignment has been in operation since 1996 on the non-dedicated high speed link), but does highlight an area that was deprived in 2004 and has subsequently become relatively more deprived. It neighbours another LSOA also confined by the MUP barrier but has changed very little in rank order (depicted as a grey polygon). Therefore one could suggest that the effect of the spatial confinement is a complex factor where its contribution to the continued deprivation experienced by some residents is unclear and unpredictable.

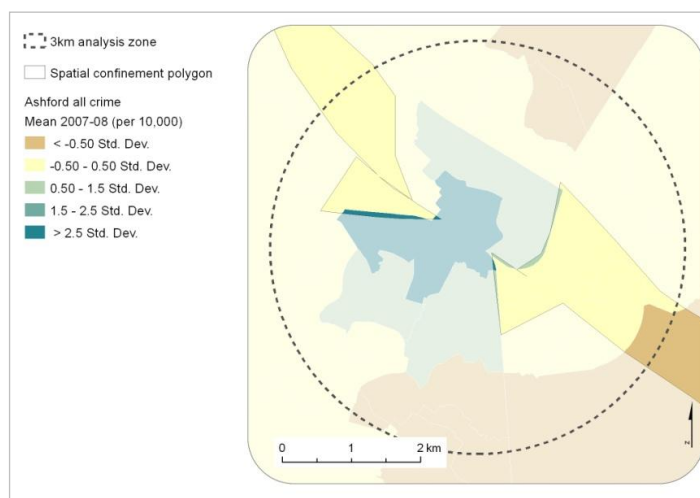


Fig. 7.104 Ashford measure of spatial confinement: Crime levels as Std. Dev. of the 10km analysis zone mean for all crimes 2007-08 (© Kent County Constabulary 2009 / www.ukcrimestats.com)

Within the confined space between the railway lines in Ashford, the Kent police statistics for all crimes between mid-2007 and mid-2008 at ward level indicate that the crime rate is within one Standard Deviation³ (Std. Dev.) of the 10km analysis zone mean (fig. 7.104). Much higher crime levels (>2.5 Std. Dev. above the mean for values across the whole 10km zone) are noted in the core of the urban area, but *not* relatively more confined post-MUTP delivery.

Ebbsfleet

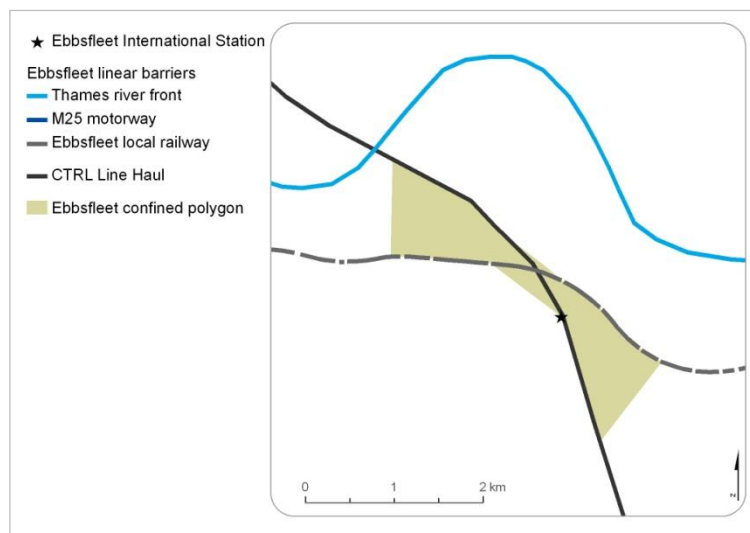


Fig. 7.105: Ebbsfleet measure of spatial confinement: confined area polygons

The area of the confinement polygon in Ebbsfleet is much smaller, 219ha, and restricted to the intersection between the CTRL line haul and the local North Kent train alignment (fig. 7.105). The remainder of the line haul has over 1km separating it from the other major linear infrastructure 'barriers'.

The OAC map for the Ebbsfleet confinement polygon (fig. 7.106 below) is dominated by three main demographic groups within the polygon's extent: Older Workers, Young Families in Terraced Housing and Younger Blue Collar. Small pockets of Least Divergent and Public Housing are visible to the north-west of the polygon.

³ The 'Standard Deviation' (Std. Dev.) is a measure that gives an impression of how close to the mean (average) a value is. In a range of values that are 'normally distributed' or like a bell curve around the mean value, 68.2% of values are classed as being within +/- 1 Std. Dev. Therefore values of +/- 0.5 Std. Dev. are very close to the mean, and increasingly higher bands indicate that the value is further from the mean.

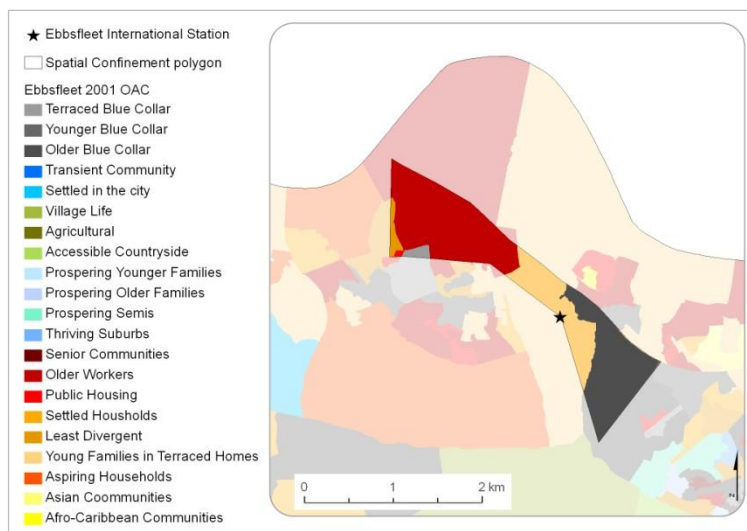


Fig. 7.106: Ebbsfleet measure of spatial confinement: confined areas aperture and 2001 OAC (Groups) [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

These are demographic groups that are often associated with higher relative deprivation and it is not surprising that the subsequent map (fig. 7.107 below) confirms that the confinement polygon is over LSOAs that are in the most deprived quintiles for the Ebbsfleet 10km analysis zone. However, some of the LSOAs have improved in rank (in blues) between 2004 and 2007, although those to the east have decreased.

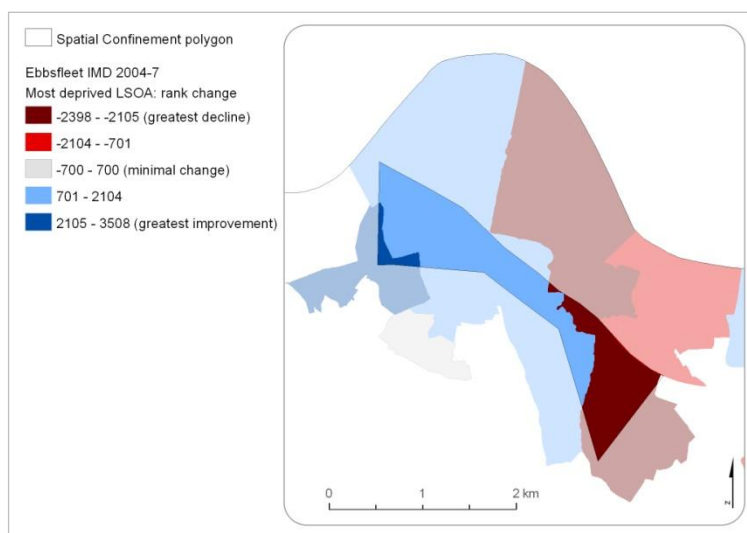


Fig. 7.107: Ebbsfleet measure of spatial confinement: confined areas and Index of Multiple Deprivation (rank changes between 2004-07, most deprived lower super output areas) [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

Similar to the situation in Ashford, Ebbsfleet's relatively confined space has average levels of all crime relative to the wider 10km analysis zone (fig. 7.108). Higher levels of crime (>1.5 Std. Dev.) exist to the north-east, where the Northfleet community has long-term confinement between the North Kent Railway line and the Thames river front.

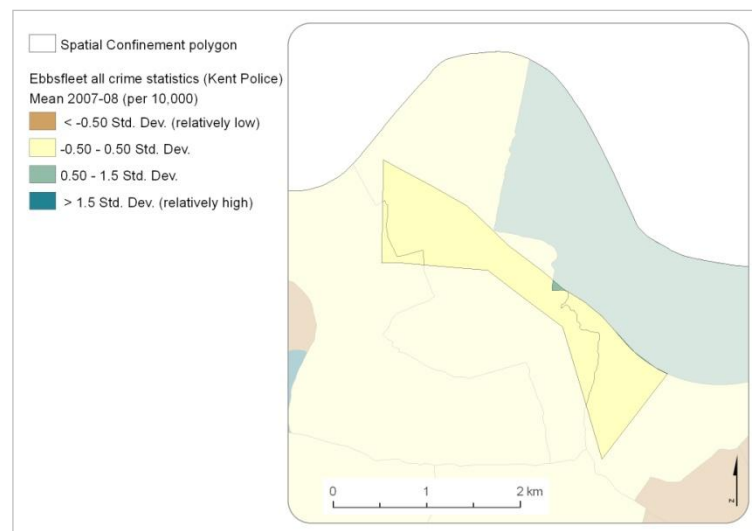


Fig. 7.108: Ebbsfleet measure of spatial confinement and Std. Dev. of the 10km analysis zone mean for all crimes 2007-08 (© Kent County Constabulary 2009 / www.ukcrimestats.com)

However cause and effect is not proven and it would appear from this map that the confinement of this space does not result in an immediate higher than average crime level.

Mapping the Ebbsfleet Valley development along with the dwelling locations reveals that the space in the confinement polygon is thus far relatively unoccupied (fig. 7.109), with very few residential buildings in this zone. It will be used as part of the Ebbsfleet Valley development, the 'Portland' neighbourhood to the north and Springhead Park to the south, for mixed use including residential (see the Ebbsfleet Masterplan appendix 10.10). Currently it is used as part of the 9,000 car parking spaces to fulfil the remit of Ebbsfleet as a parkway alongside the M25 motorway.

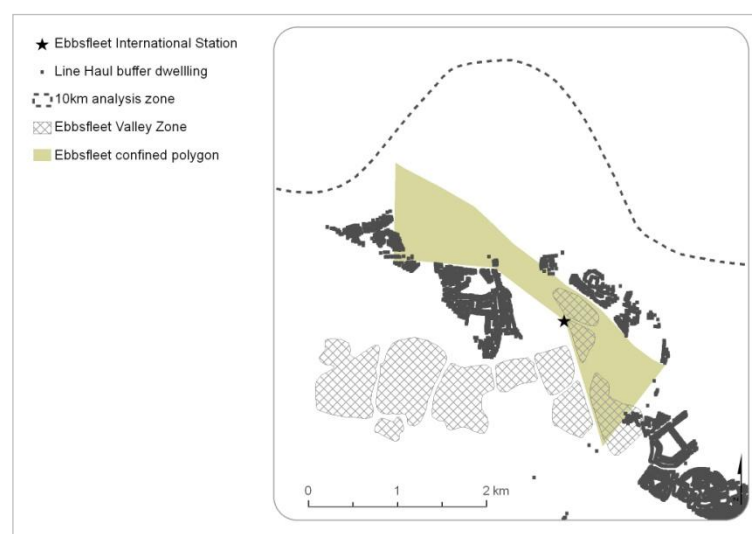


Fig. 7.109: Ebbsfleet measure of spatial confinement: confined areas, Ebbsfleet Valley development zone and dwellings [©Crown copyright/database right 2011 Ordnance Survey Mastermap2 / EDINA Digimap]

The Community Segregation sub-indicator

Ebbsfleet

As noted in a preceding section (methodology 7.4a), an influx of a population who are of a different demographic profile than the incumbent residents of an area can, if forced to interact at a level that both groups find uncomfortable, could lead to resentment and tension.

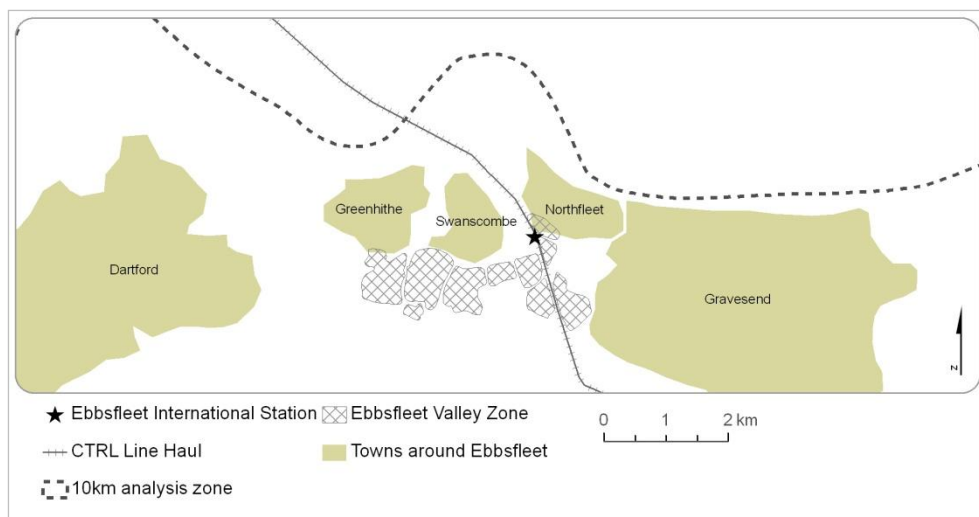


Fig. 7.110: communities around the proposed Ebbsfleet Valley Development

Exploring the master plan for the Ebbsfleet Valley development (below fig. 7.111 compared to size of current communities in fig. 7.110) it would seem that the new population will be highly contained within the environment of the former chalk and clay pits, but is this for the good of the greater community? Does the CTRL line haul impact upon the segregation? Should it?



Fig. 7.111: Ebbsfleet Masterplan [© ebbsfleetvalley.co.uk-accessed Feb. 2010]

As the Ebbsfleet Valley development, at the time of writing, remains un-built due to the recent financial crisis, we can temporarily adopt the OAC typology assigned to the Eastern Quarry chalk pits, 'Aspiring Households' (dark-orange), as the anticipated demographic for the whole development (fig. 7.112).

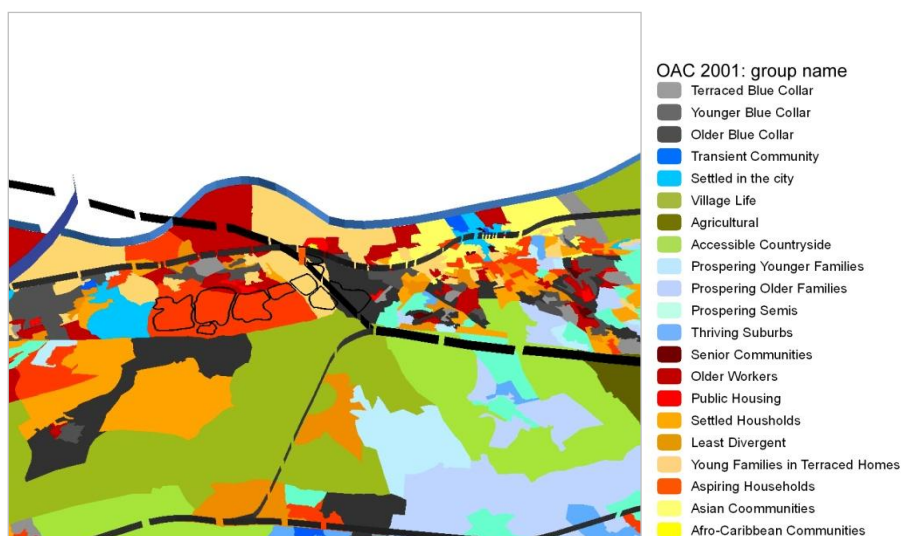


Fig. 7.112: Ebbsfleet OAC group, physical barriers and the MUP-related new development [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

The surrounding demographic groups illustrated in fig. 7.112 above are of a wide variety, from Senior Communities to the north, Settled in the City population west in Dartford, Blue Collar communities to the south and east and rural village life to the south-east. OAs dominated by Young Families in Terraced Homes are also present in the immediate vicinity. With regards to deprivation, the most recent Index of Multiple Deprivation (2007) map at Lower Super Output Area level, the Ebbsfleet Valley LSOA is anticipated to be of relatively low deprivation (see fig. 7.113 below), as are some of the surrounding LSOAs, although higher relative deprivation is recorded north and north-east of the development.

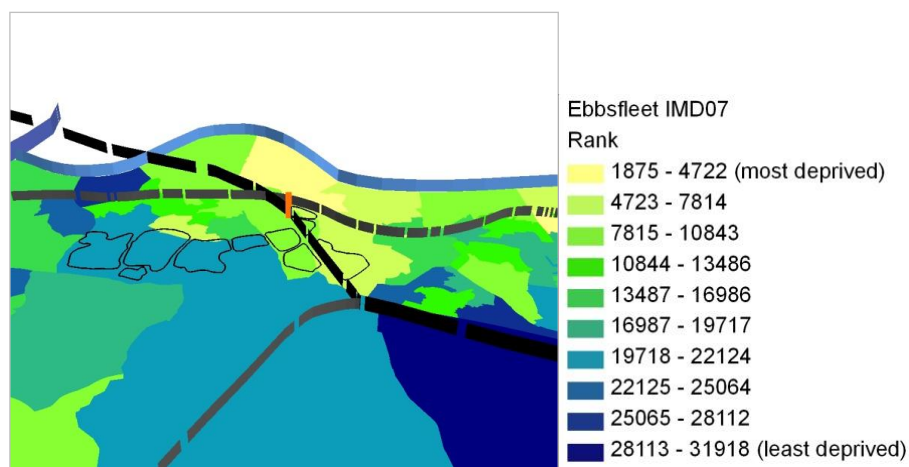


Fig. 7.113: Ebbsfleet IMD 2007, physical barriers and the MUP-related new development [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

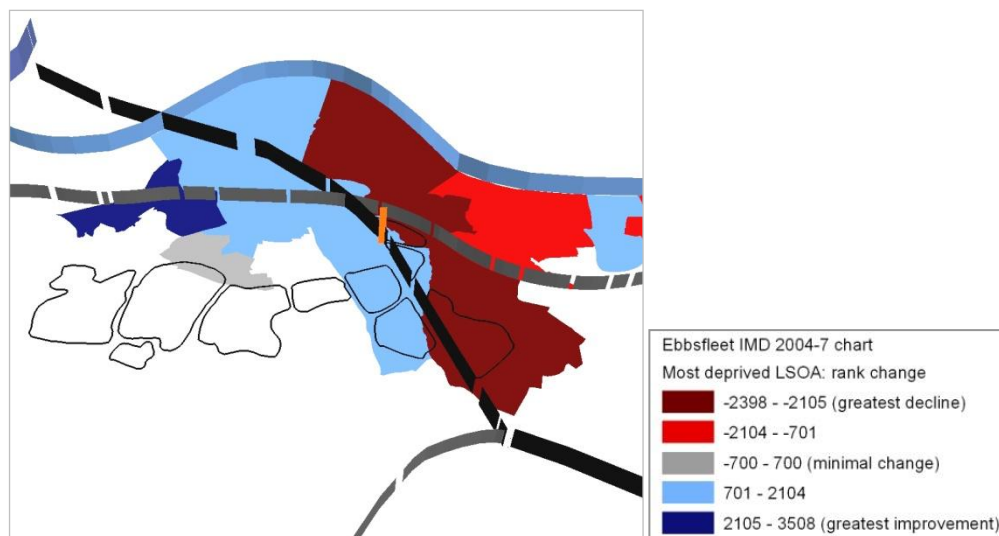


Fig. 7.114 Ebbsfleet IMD rank change 2004-07, physical barriers and the MUDP-related new development [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

Indeed the development is south of the LSOAs in the most deprived quintile for the 10km Ebbsfleet analysis zone. Some of these, in fig. 7.114, have in the three years between 2004 and 2007 become more deprived (in deep red) although others have improved in their rankings (in light blue). So one could surmise from these projected characteristics that the new development will be of a different nature demographically and of relatively different (multiple) deprivation levels to the surrounding communities. The man-made chalk cliff-face (and planned artificial lake) to the south of the development along with the A20 provides a significant barrier between the new residents and the rural population. Bluewater shopping centre and its associated infrastructure provide a significant barrier to the west, hence only the northern border is relatively accessible in theory with the existing communities at Swanscombe and Greenhithe. However the roads within the masterplan do not extend beyond the development, with a stretch of green belt existing between the two communities (see figs 7.111 and 7.115). The CTRL line haul to the east separates the majority of the new population to the predominately Blue Collar, relatively high deprivation neighbours, aside from the most peripheral, easterly section of the development, Springhead Park. This latter development is the scheduled to be first to be completed and the most 'integrated' with the local population of Gravesend (fig. 7.116 below). The CTRL line haul in this case is a barrier between this development and the main Ebbsfleet Valley homes, although Springhead Park is scheduled to be completed sooner. It is possible that its residents will have a perception of their neighbourhood orientated more towards the existing community at Gravesend than the other MUDP-related dwellings being constructed in the next 20 years.

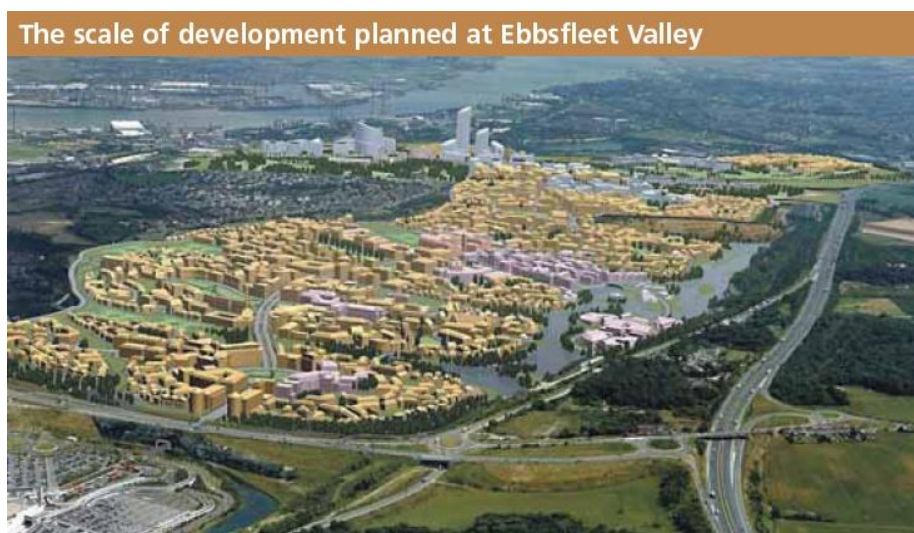


Fig. 7.115: Ebbsfleet Valley Development, looking eastwards, Bluewater shopping centre in the lower left-hand corner. [© Kent County Council 2006]



Fig. 7.116: Ebbsfleet Valley Development, looking westwards. Springhead Park in the foreground, old and new community 'boundary' circled in red. [© Kent Thameside 2007]

The Impeded Access sub-indicator

Ebbsfleet

Extracting residential dwellings in Ebbsfleet from the OS MasterMap Address Layer 2 that fall both within the 3km analysis zone around Ebbsfleet station and a 1km line haul buffer gives a sample of 6,959 homes. The locations of health and education, recreational, and retail facilities are also plotted (fig. 7.117 below).

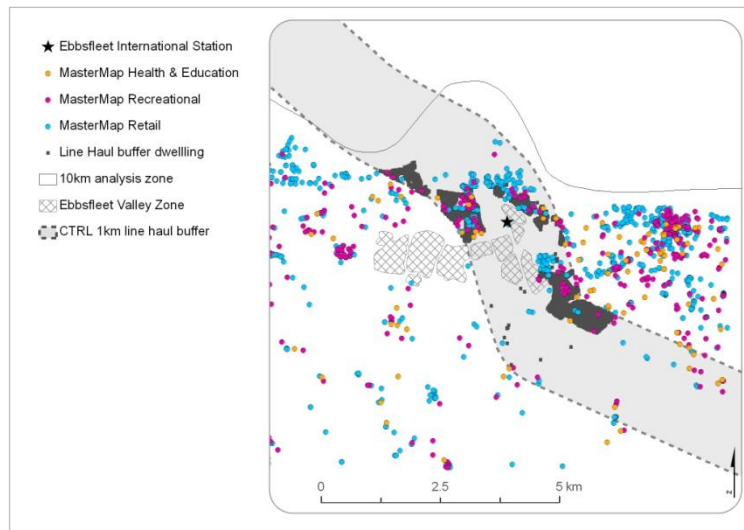


Fig. 7.117: Ebbsfleet dwellings in 1km line haul buffer and all facilities [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Creating a simple nearest neighbour (Euclidean) path between each dwelling and facility subset, it is possible to note which dwellings are closest to a type of facility that lies across the railway line haul. For the purposes of brevity, the nearest neighbour path is to the closest location point to any of the types of facility within the subset, but clearly one's proximity to a tennis court for example, is no substitute for a library. Hence, for a more realistic usage, the facilities would need to be more carefully distinguished. For this impact indicator only the Health and Education subset is presented within this chapter, and further broken down to look closely at Clinics and GP Surgeries. Improving ones accessibility to such healthcare provisions is a countrywide mandatory accessibility target (D.F.T. National Core Accessibility Indicator NI 175) and thus it is deemed more important to the general populace over other types of facilities.

The nearest neighbour paths to the closest retail and recreational facilities subset are provided in the appendix (10.11). The Health & Education facility locations (fig. 7.118 below), and the nearest neighbour paths (mean:337m, min:3m, max:1361m, 1 Std. Dev.:177m) do not differentiate between the facility types. Clearly a nursery and a secondary school meet different needs, but a greater finesse would be required to carry out this indicator analysis for a meaningful real-world output. As expected, the dispersal of this set of facilities is much greater; each facility serving a larger proportion of the local population than recreational or retail facilities. Yet two areas of residential dwellings are required to cross the line to access any health or education location, two remote dwellings (in fig. 7.119), and another cluster of dwellings to the north, are explored further in the final set of maps (figs. 7.121 and 7.122 below).

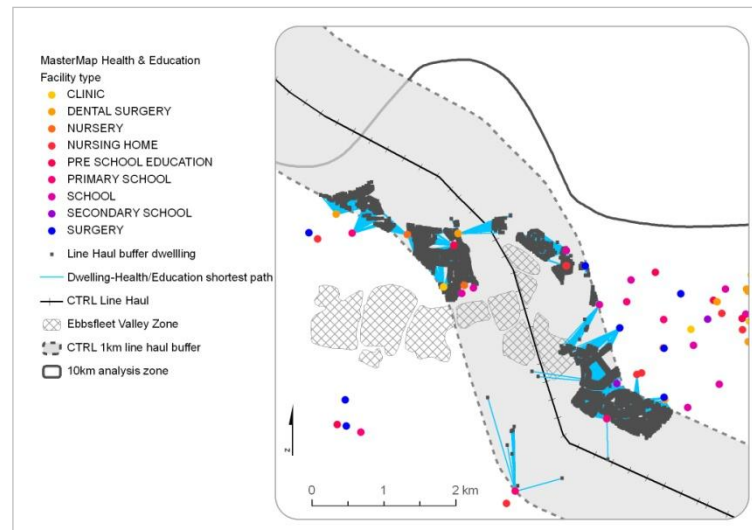


Fig. 7.118: Ebbsfleet line haul dwellings and nearest neighbour paths to Health & Education facilities [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]



Fig. 7.119: Ebbsfleet line haul dwellings and close up of nearest neighbour paths to Health & Education facilities [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The Health & Education subset has been further broken-down to Clinics and GP Surgeries only, a class of facilities to which local access is important. In this example, many dwellings require crossing the line haul to their nearest facility (fig. 7.120). The mean nearest neighbour path distance here is much further at 669m (min:3m, max:2348m, Std. Dev.:285m). This can be expected as the number of locations explored is reduced to only six facilities within reach of the dwellings. To the north (fig. 7.121 below), 423 dwellings are required to cross the line-haul (and an area which is currently a large surface car-park) to access their nearest clinic located in Swanscombe (mean distance 1182m). The road network does not provide a rapid access over the railway line and the journey is not straightforward. Given the distance to the clinic away from the line haul, the addition of a new foot and cycle bridge would not realistically alleviate the accessibility issue for these dwellings. Further south (fig. 7.122 below), the residents of 10 dwellings need to travel over

the line haul to access a GP surgery (mean distance 1822m), their nearest neighbour paths crossing the line haul in a variety of locations that do not coincide with a current road traffic bridge.

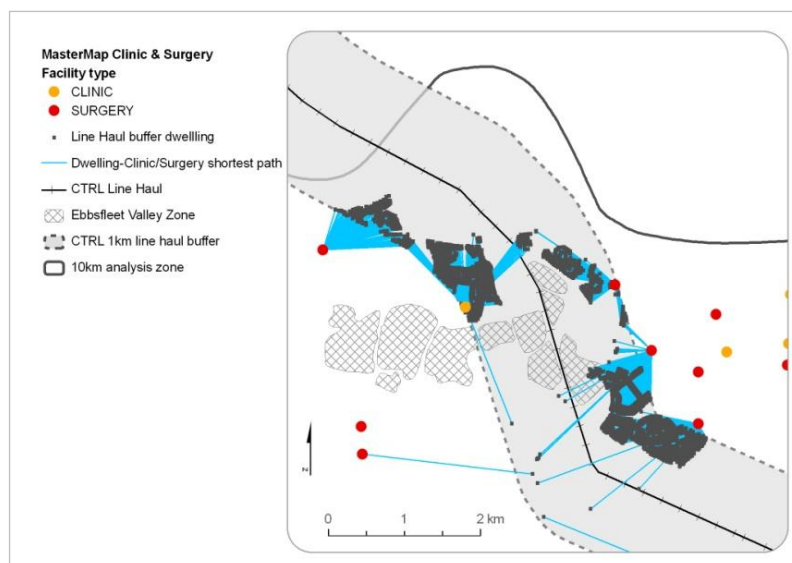


Fig. 7.120: Ebbsfleet line haul dwellings and nearest neighbour paths to clinics & GP surgeries [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]



Fig. 7.121: Ebbsfleet dwellings and nearest neighbour paths to clinics & GP surgeries facilities [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The addition of the Output Area Classification to fig. 7.123 clarifies that these remote dwellings in the southern portion of the study area are located in the 'Village Life' demographic class, although they are relatively sparsely located. One might presume that living in this setting would require car use to access any facility and a longer car journey and lower accessibility are expected.



Fig. 7.122: Ebbsfleet dwellings and nearest neighbour paths to clinics & GP surgeries facilities [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]



Fig. 7.123: Ebbsfleet line haul dwellings and close up of nearest neighbour paths to clinics & GP surgeries facilities with 2001 OAC [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

Hence there are instances unsurprisingly where traversing the line haul is necessary, and no doubt this situation would be further clarified by reducing the coarseness of the facility classes. Currently, with the present impact parameters, no single spatial location presents itself as highly beneficial to place a new crossing to shorten the distance to facilities for residents. One final context specific comment is needed: the two dwellings that appear to be rather cut off from a variety of facilities (e.g. fig. 7.119) could benefit greatly by the Ebbsfleet Valley development on their doorstep which would provide access to all classes of facilities, assuming that the development is permeable to outside residents.

7.4c

The Physical Barriers indicator: Findings & critical assessment

Indicator Aim

This indicator aims to help planners identify if there are areas at risk of physical and social marginalisation, or a general decrease in the standard of living due to the MUTP and its associated infrastructure.

When the line haul alignment is decided upon, it is inevitable, as with all mega infrastructure projects (transport or otherwise), that there are ‘winners’ and ‘losers’; socially, economically, spatially, financially and visually (Atkins 2009, D.C.L.G. 2009). Some degree of discomfort is to be expected and planners would hope that these are offset overall by the benefits of the MUTP to the whole area. Hence this indicator set attempts to consider some of the direct impacts.

The Neighbourhood Division sub-indicator:

‘Does the railway line separate members of a neighbourhood?’

Initially the OAC-group based neighbourhood division was examined, whereby the line haul cut through spaces that have been designated the same demographic typology. In Ashford there appeared to be several instances of this occurring towards the outskirts of the main urban centre. In some cases, there were passes to enable people of either side of the railway line to traverse. In Ebbsfleet there seemed to be only two instances of this occurring. In both cases, once the MasterMap Address Layer 2 dwelling locations were superimposed upon the OAC groups (fig. 7.99), it was clear that in the much less densely occupied region, the ‘neighbourhoods’ were either very separated clusters of dwellings, or there were no dwellings on one side of the ‘dividing’ line haul. This emphasised the need to utilise the Output Area Classification groups only as a very broad starting point and that dwelling location can radically alter the perception of this impact. Furthermore, it is likely that people living within these OAC groups do not perceive such boundaries, and different tenures of housing do not necessarily split an area into different neighbourhoods (especially as these classifications are merely ‘typical’ and not exclusive characteristics). Possible future applications of this sub-indicator could display only the MasterMap dwelling locations displayed by the colour of their respective OAC groups, and the point size dependent upon the numbers of dwellings at that location so as to distinguish between high density, multiple occupancy dwellings from single households. This enhanced dataset displayed within a 1km corridor buffer either side of the line haul could refine the sub-indicator and provide a more targeted approach to assessing neighbourhood division without very much more data

processing. Defining a neighbourhood has been an elusive process for cartographers and this application can act as the base starting point, supplemented by the planners' local knowledge of the communities. The 3D rendering of the linear barriers was thought-provoking, although the dynamic view in ArcScene was considerably more powerful in communicating the barrier's potential impact on the urban landscape than the static 2D 'screen-captures' convey, and was straightforward to operationalise.

The Spatial Confinement sub-indicator:

Are areas of entrenched multiple deprivation made 'worse' by spatial confinement following the construction of a railway line, as living in a 'bad area' exacerbates vulnerability to poverty?

The spatial confinement sub-indicator explored newly enclosed spaces although it was awkward to define an arbitrary limit on what made a previously un-enclosed space 'confined' with the available tools of the GIS: Would 500m between barriers make residents feel more bounded? Would it impact upon socio-economic processes (such as continued entrenched deprivation and high crime rates), and if not 500m, would 1000m, or 1500m? Part of this issue is the personal perception and context specific spatial configuration of the landscape, but again, GIS maps were a good starting point. The polygons in the output maps indicated where the spaces that were relatively more confined, even if not all the residents within that space perceived it or considered it an overtly negative impact of the MUTP.

Being able to make an aperture through which planners can view OAC demographic groups, IMD rank changes, MasterMap dwelling locations or the road network and so forth was helpful in assessing the level of confinement and possible short and long-term impacts. However the sub-indicator relied on a polygon definition that was currently arbitrary but would benefit from an improved technique. The use of Space Syntax Analysis could be of help to examine the 'axial depth' changes in permeability between neighbourhoods after the introduction of the railway line. Axial Depth mapping is one of a range of analyses in the Space Syntax compilation (Hillier and Hanson 1984) and works well at the small to medium urban scale such as the 3km-10km zones of the hubs. It enables the modelling and exploration of form and function of the built environment, leading to comparisons with pedestrian and/or social behaviour by calculating the 'mean depth' of each road / footbridge node. Research demonstrates that people's perception of space and how to move between two points closely resembles the properties represented in an axial map (Kim and Penn 2004). The inclusion of space syntax tools within a GIS environment since the late 1990s has aided the understanding between urban form, social behaviour and (geometric) accessibility (Jiang et al. 1999). See an initial Depthmap of Ebbsfleet in fig. 7.124 below. Vaughan (2005:89-90) adopted such an approach to assess the level of segregation of the immigrant Jewish quarters in London, Manchester and Leeds. She found that they exhibited more spatially segregated layouts than surrounding neighbourhoods, which in turn lead to

continued poverty not only for the immigrants but the other occupant population of the area. She goes on to suggest that it was the spatial planning and urban design of the area that contributed significantly to the deprivation experienced by the residents (ibid. 91-92).

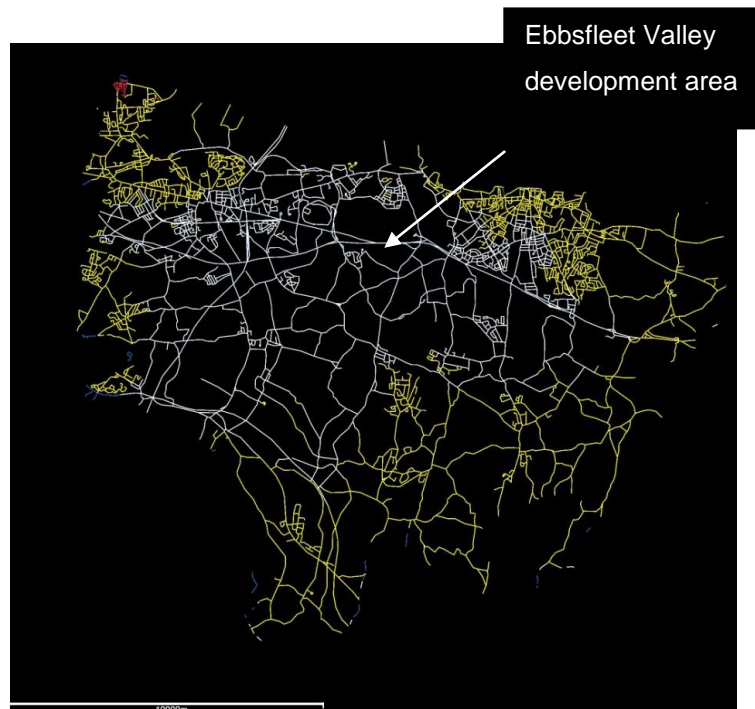


Fig. 7.124 Ebbsfleet Axial Depth Map (radius n (global)). UCL Depth Map/Space Syntax Ltd [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Ghetto-ising of the relatively most deprived areas of the hubs is clearly to be avoided, and the planners and decision-makers are able to consider the needs of the residents who find themselves in these new relatively confined spaces. In Ashford, some of the LSOAs in the most deprived (2007 IMD) quintile and falling in rank between 2004 and 2007 were located in the new relatively confined space. In Ebbsfleet the confined space is as yet rather unoccupied. In both cases, reported crime levels were, as of 2007-08, average for the area, between -0.5 and 0.2 standard deviations from the 10km mean.

The Community Segregation sub-indicator

Are the populations expected to occupy the new MUDP-related developments of significant socio-economic contrast to existing populations that a physical barrier would be of benefit?

The utilisation of the line haul as a physical barrier to segregate old and new communities is possibly an 'unintended' outcome in that the alignment is unlikely to have been chosen with this in mind. However, the sunken-trench construction of the CTRL line haul through Ebbsfleet means that visually there is no interruption across the landscape. Yet there is a physical barrier that reduces the need for communities to share space if it is not desired, as discussed above (section 7.4a). Adding previously created maps such as the IMD 07 rankings and the most deprived LSOAs (difference in rank between 2004 and 2007) as ancillary data enables planners to view how different the existing communities are to the

expected new population at Ebbsfleet Valley. These latter maps confirm that the old community on the borders of the new build is both absolutely deprived and relatively increasingly deprived. This is a situation that will hopefully turn about with the changes the area is undergoing following the start of the CTRL service. Without point location data for the proposed community facilities in Springhead Park, estimating where and how often the old (typically Blue Collar) and new (hypothetically typically Aspiring Households) communities may interact is not knowable at the present time. Moreover, local planners will be provided with sufficient knowledge to promote positive interaction whilst sensing the dynamic of the community members and comprehending the extent to which they may or may not wish to interact. Contextual 'ground-truthing' regarding the residents living in households of lower incomes would be helpful to assess how they conceptualise their neighbourhood, how the new MUDP-related development impacts upon them and how we can clarify the nuances of social norms. Studies such as that of Flint and Casey (2008) demonstrate that living in an area of relative deprivation does not necessarily lead to tension or resentment between of groups of different socio-economic status. Qualitative data such as these would provide a basis for approaching the coalescing of the new community, to what extent and where the residents could mix.

The Impeded Access sub-indicator:

Is there decreased accessibility to local facilities following the construction of the MUDP?

The final element of this indicator set assessed potential decline in accessibility to local facility because of the line-haul. This was explored in Ebbsfleet only due to the availability of the MasterMap Address Layer 2 locations of dwellings and pertinent facilities. Calculating 'straight-line', as opposed using the actual road network distances highlights where the nearest facility for some dwellings was across the line haul. In some cases the road network would lead to a considerably longer journey than by pedestrian or cycle using a small pass across the line. The shortcomings with this execution of the impact are mentioned above (section 7.4b) and include the coarseness of the facility classes that mask the true extent that some facilities are now comparatively harder to access. Also the 1km corridor buffer was an arbitrary distance and a rather blunt cut-off, which could be improved by a hierarchy of buffers for example, 500m, 1000m 1500m from the line haul. This reflects that there are some facilities to which people would be prepared to travel further to such as secondary schools or a hospital, given their relative scarcity in an urban area compared to shops or pubs (see supplementary maps for retail and recreational access in appendix 10.11). Overlaying the output, 'nearest neighbour paths', over the OAC typology was not as elucidating as anticipated. Ascertaining the location of the Rural / Village Life class dwellings (fig. 7.123) meant that some of the residents required to traverse the line haul to access some facilities, were already considerably distanced from the towns and would need to traverse the A20 trunk road previously anyway. Conversely access restrictions due to the line haul could have severely hindered the use of the shops or recreational facilities of the

new development by the existing community members if they had wished to do so, without sufficient passes at optimal places. Without more detailed locational information for the facilities planned for the new development, it is not yet possible to say if walking accessibility is viable. Perhaps the new schools and shops will be only accessible realistically to the population in Ebbsfleet Valley, irrespective of the location of the railway line haul. Space Syntax analysis, specifically Mean Depth maps, could be of use to assess the difference in permeability over or under the linear barrier that the CTRL line haul presents. Placing hypothetical foot and cycle bridges at various places and assessing the difference this makes to the accessibility and movement of residents, along with the layout of the new development would be a valuable exercise.

Guidelines for planners and decision-makers in the future

Coarseness of both the spatial resolution and classification of attribute data along with the subjective nature of the impacts discussed above makes this indicator hard to interpret without much more in-depth local knowledge. However the maps are clear and serve to indicate areas that would benefit from close monitoring and lead to formulating context-specific evaluations regarding any short- and long-term links between the effect of the MUTP linear barriers and entrenched deprivation and/or high crime rates.

Lessons-learnt for planners and decision-makers in the future

The output maps for these sub-indicators are relatively simplistic and by no means convey the full extent of the socio-economic effect that the physical line-haul may be having upon the hub's residents. The processes range from the 'known' to 'complex' domains, primarily relating to the level of subjectivity regarding the effect. The Impeded Access sub-indicator reflects a 'known' process whereby planners and decision-makers are able to 'sense-categorise-respond' as per the *Cynefin* decision model (chapter 6) impacts of the reduction in accessibility to these local facilities, potentially by the addition of foot and cycle paths and other mitigation measures. The impact of Community Segregation could be 'knowable' over a period of time, although the influences of other socio-economic factors, such as the gentrification of the old neighbourhood due to house price rises for example, could mean that this process shifts into the 'complex' domain. The effect of not segregating the two communities may never be fully quantifiable or repeatable in another context. The two remaining sub-indicators - Neighbourhood Division and Spatial Confinement - are also 'complex' processes, due to the variation in the perspective of each individual of these impacts, and the emergent properties of the effects may only be coherent in retrospect. Therefore attempts to extract lessons-learnt from these MUTP impacts will be limited to the specific context. As with previous 'complex' process impacts, forewarning of, and pre-planning for the potential for negative outcomes is highly beneficial, particularly the preparation of amplifying and dampening strategies.

7.5a

The Journey to Work indicator:

Methodology

The Journey to Work analysis comprises two separate but related variables; travel to work Origin-Destination workplace flows for daily commutes (the 'where' sub-indicator), and mode choice (the 'how' sub-indicator). Can planners utilise the delivery of the MUTP to discourage the rise of car use and improve the usage of relatively sustainable modes for commuting both locally and regionally? This theme is primarily developed around descriptive statistics and does not use discrete choice models or other detailed analysis of travel behaviour, although these are feasible for a more in-depth exploration as to the causes of the spatial patterning present in the data outputs. However the ideas present in the indicator methodology are drawn from a rich source of modelling regarding the impacts and effects of socio-economic factors on the how and where of every day journeys people make (such as multinomial logit or conditional logit models (Ben-Akiva and Lerman 1979, de Palma and Rochat 2000, Asensio 2002, Dissanayake and Morikawa 2005, Vega and Reynolds-Feighan 2008, Commins and Nolan 2011)).

The spider diagram below (fig. 7.125) is adapted from a report (Transport Scotland 2007) examining the impacts for users of car, bus and train in Scotland and provides the relative incentives or deterrents to using a travel mode. This scale for the graph is arbitrary and the profile is highly context specific. Many variables relating to demographics, pricing structure, and the form of the local/regional transportation network for example would illicit pressures that affect the profile of the graph. Yet it serves to illustrate that the various modes perform better than others on differing facets, and where planners can foresee opportunities to improve bus and train use over car.

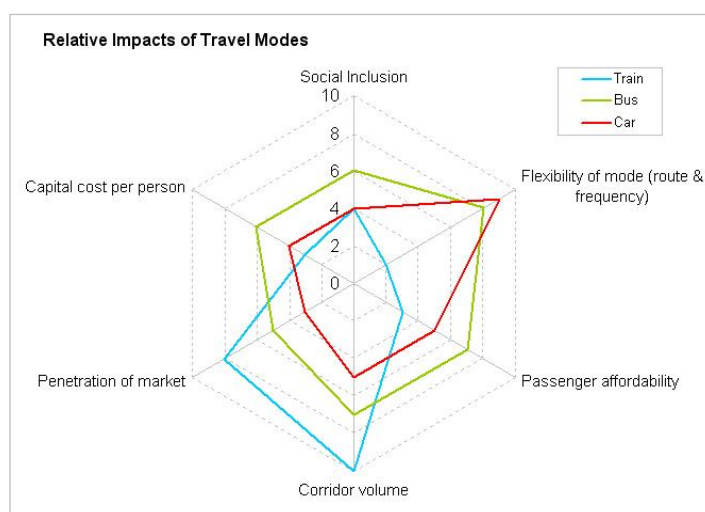


Fig. 7.125: Travel modes strengths and weaknesses (derived from Transport Scotland (2007))

Potential benefits for the MUTP appraisal

Two positive changes in the community that could be considered as beneficial distributive impacts for the MUTP appraisal are:

- commuting flows: more local job opportunities following the MUTP development could result in less commuting
- mode shift: more sustainable mode usages and less car journeys with MUTP-related local transport changes including improvements to station access routes for cycling and pedestrians, and BRT feeder services

Aim of the indicator

The aim for this indicator is to help planners ascertain the local travel-to-work patterns and a baseline of transport modes used so as to facilitate appropriate MUTP-related transport changes to encourage less car use for all distances of commutes.

Objectives

- Demonstration of the Journey to Work patterns over time in the analysis zones of the hubs, with clarification of the differing workplace flows associated with quintiles of relative deprivation.
- Illustration of distribution of modes of transport used by the different quintiles of deprivation over time, with the aim of formulating a context specific approach to encouraging sustainable modes of transport; long distance commuters via train and local (short to medium distance) commuters via buses, bicycles and walking.

Method: Journey to Work, the 'who is going where' sub-indicator

Created solely from the 2001 census output, the Journey to Work datasets were collated through the extraction of CIDER-based 'Special Workplace Statistic Level 2' data for total employees, which produces origin-destination interaction flows for journey to work. These interaction data were divided into subsets only for the *highest* and *lowest* quintile wards in the Carstairs deprivation score for 2001 (see Carstairs and Morris 1989, Morgan and Baker 2006 for definitions of the Carstairs Score inputs). These interaction flows were carried out from ward centroid to ward centroid (population density weighted) in a direct line. Hence these only roughly equate to real distances travelled by the ward residents. The distances were further divided into six classes; intra-ward, up to 10km, 10-25km, 25-50km, 50-100km, 100-∞km from the origin ward centroid. Membership of a workplace flow in one of these distance bands is shaped by micro (local) and macro (regional) job opportunity destinations. The distance band minimum-maximum values become increasingly broad as the point-to-point distances deviate ever more from the real world road or rail network distances. For refinement upon the intra-ward distance, one could adopt half of the square-root of the ward surface area to approximate the distance between two random points in the neighbourhood (Ghosh 1951). This is unnecessary for the purposes of this study, and furthermore it is

possible (although it did not occur here) that two random points within a single ward could be further than two neighbouring ward-to-ward points depending on the configuration of the population weighted centroids, and the density and shape of the ward boundary definition. In any case, this distance band is uniformly entitled 'intra-ward' without specifying kilometres.

Initially an origin-destination (OD) flow from the centroid of each least and most relatively deprived ward in a hub is generated with distance bands, which are then converted to vertical bar chart to explore the distribution. Note that for the 1991 census dataset, the 10% sampling strategy resulted in some very low numbers of interaction flows. Therefore any real value between one and three OD flows was rounded up to three or down to zero, so the minimum interaction flow between two OD points mapped here is three. Only a small selection of individual ward OD flow maps will be included in the output maps section below (7.5b), the remainder are placed in appendix 10.12. The maps chosen for inclusion are based on their interaction patterns; one 'typical' and one 'atypical' for that area.

In the final part of this sub-indicator, the most and least deprived wards (five of each in Ashford, eight of each in Ebbsfleet) are combined to produce a mean number of flows per distance band for most and least deprived. This is tested for significance by the use of the Kolmogorov-Smirnov test (KS-test) that determines if the two datasets differ significantly without any assumption as to the distribution of the data. This can provide an indication if on average, those living in the most relatively deprived wards, travel significantly less far than those in relatively least deprived areas. Once this has been established, decision-makers can shape feeder-bus services and other MUTP-related local transport improvement initiatives to coincide with the sections of the hub population that commute more locally to work, whilst providing a sustainable mode to access the MUTP without a car.

Method: Mode, the 'how are they getting there' sub-indicator

In assessing the prior patterns of the primary travel mode used (in terms of distance travelled) for the commute to work at the case-study hubs, the 1981 (table SAS047), 1991 (table SAS082) and 2001 (table KS015) censuses are used. So as to achieve latitudinal coherence between wards (as the spatial boundary definitions and reference codes are dissimilar over the censuses), a new spatial selection is created. This is done by joining the population-weighted centroid of 1981 and 1991 Enumeration Districts to a larger 2001 ward whose boundary they are located within and aggregating their values. Subsequently, subsets of those wards that were recorded as having the highest and lowest relative Carstairs deprivation scores in 1981, 1991⁴ and 2001 are created and linked to the Means of Travel to Work census tables, which in 1981 and 1991 are a 10% sample. The census tables provided

⁴ 1981 and 1991 Carstairs Scores were re-generated at the 2001 Census Area Statistics Ward definition by Dr Paul Norman of Leeds University [email June 2009].

counts for total persons by car pool, car passenger, car driver, bus, BR train, underground, motorcycle, pedal cycle, on foot, other / not stated, works from home. These categories are conflated to generate six main classes: bus, train, motorbike, bicycle, walk and car. 'Not Stated' or 'Works from Home' responses have been further discounted from the assessment.

For the first visualisation of this indicator, pie-charts indicating the six mode distribution per ward for 1991 (pre-Ashford International CTRL service in 1996) and 2001 (pre-Ashford and Ebbsfleet HS1 domestic service in November 2007), are created. This is followed by a two variable pie-chart illustrating the proportion between 'Sustainable modes' use (bus, train, walk, bicycle and motorbike combined) vs. 'Car' use (including car passenger). This latter dataset is transformed to a choropleth map to display the percentage of the population using sustainable modes at a 10% sample for 1991 census and 100% sample rate for 2001. A final map indicating the differences between these percentages (rise or fall) of those using relatively sustainable modes (i.e. not by car) for their journey to work is created. There is an associated vertical bar chart that clearly demonstrates the level of percentage change across all wards.

The second part of the output section moves away from the spatial aspect of the modes to assess the proportions of the most and least deprived populations using each mode from 1981-2001. Extracting table data from the GIS removes the visual and computational complexity of the 1981 and 1991 Enumeration Districts and 2001 Output Areas having different boundaries. Also the locations of the wards ascribed to each Carstairs Score quintile for relative deprivation vary over the decades making comparisons problematic. The vertical bar charts provide rapid assimilation of the trends of mode use in the last three censuses.

The third element of this impact indicator combines the Accessibility Measure information from chapter 7.3b with the mode datasets; the Fastrack BRT route B stops and SmartLink BRT buffer. This demonstrates an example of how MUDP-related local transport improvements could influence the use of non-car modes in commuting for all the population within its catchment regardless of deprivation level, provided it is affordable.

A final variable is the exploration of the proportions of primary commuting modes used with regards to the categories from the 'Travel Needs SuperSegments' that combined OAC demographic information with a public Transport Needs Index (TNI) (Duckenfield 2009). This permits local transport planners to consider the proportion of public transport actually recorded as being utilised by those classified as most in need of public transport (particularly bus ridership) as discussed in the Accessibility Measure indicator (chapter 7.3).

Future guidelines for planners and decision-makers

Understanding where and how the population travels to work forms a fundamental dynamic of transport use from which planners and decision-makers can propose new transport initiatives to reduce car use at all levels. This indicator set provides the visualisation framework to explore these commuting-related data both before and after MUDP-related transport plans take place. For this impact indicator, this section establishes a methodology and base dataset as the real impacts will be felt and recorded in the 2011 census and associated derived data such as the Special Workplace Statistics. Hence the 'impact' can be hypothesised and the situation discussed in order to maximise the social benefits from what we can currently deduce. As the census does not pose a multi-modal question, we cannot know about access nor have a full picture of mobility for these populations from this source alone.

Lessons Learnt for planners & decision-makers

Commuter work flows and primary transport mode shifts as explored in this indicator are 'knowable' processes, where decision-makers and planners can employ scenario planning and previous examples of good practice to achieve targets for reducing relatively unsustainable car journeys, and improvements to the environment to make walking and cycling to the station more attractive. The implementation of the MUDP can provide the catalyst needed for new local transport projects that can contribute towards these targets.

Cross-influence with meta themes

Whilst not specifically an input for the Community Cohesion meta indicator due to the limited sample of outputs generated for this indicator, OD workplace flows generated at a higher spatial scale (sub-ward for all of the analysis zones) would be a useful input in the future. Areas that have a high level of medium-long distance commuting can result in 'dormitory communities', whereby a relatively young, childless population leave early and come home late during weekdays. Therefore the area is relatively deserted during the daytime, and community cohesion is low (Gallent and Robinson 2011). A new MUDP that facilitates faster travel times and hence longer distance commuting can lead to this pattern of daily commuting, leaving the hub with essentially two populations; full time and part time residents. However, with journey times at 37 minutes from Ashford and 17 minutes from Ebbsfleet to central London, a 'dormitory town effect' is unlikely to result in the hubs due to this MUDP. As the focus of the Social Exclusion indicator in chapter 8 is primarily unemployment, the use of bus as a promoter of more generally defined social inclusion is not explicitly discussed although it is covered within the literary review (chapter 2.2).

7.5b

The Journey to Work indicator:

Input data and output maps

The workplace origin-destination flows sub-indicator

Ashford wards:

Extracting the most and least relatively deprived quintiles for the 2001 Carstairs Score for Ashford fig. 7.126 below (generously provided by Dr Paul Norman School of Geography University of Leeds) reveals that in 2001 these classes are spatially contiguous and distinct. The most relatively deprived are located centrally around the CTRL station and central urban core, and relatively least deprived on the urban/rural fringe. Clearly this impacts upon the distribution patterns that emerge from commuting interaction flows.

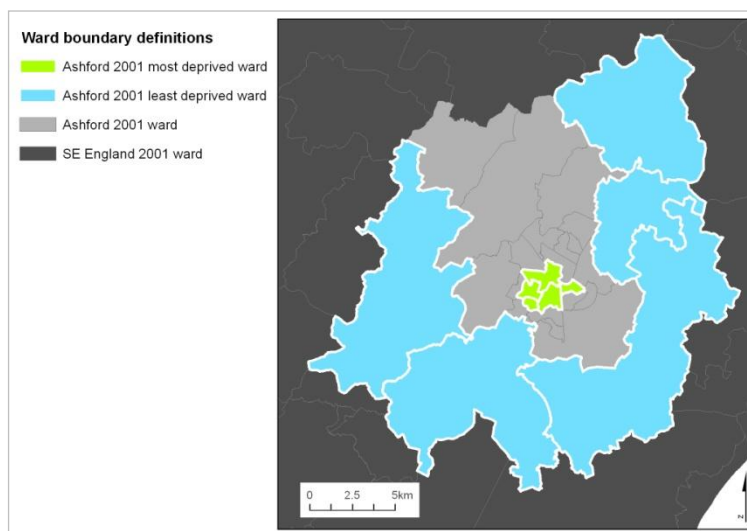


Fig. 7.126 Ashford most and least deprived wards (Carstairs Score 2001 quintiles) [Norman 2009 & 2001 Census ONS, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

When assessing the primary inputs for this indicator, two maps per most and least deprived classes have been illustrated below; one 'typical' the other 'atypical' of the overall trend to examine the strengths and shortcomings of this indicator (the remainder are located in appendix 10.12).

Ashford: least deprived wards

The demographic profiles (OAC groups) for all five least deprived wards (three are not illustrated here) are largely Agricultural and Village Life with some OA of Prospering Older Families and Typical Traits (see Demographic Profile fig. 7.2). Their demographic diversity indices range from $1-D=0.22$ in the north to $1-D=0.87$ in the south where urban and rural areas are in the same ward.

The first illustrated ward to be explored is located north-east in the analysis zone (fig. 7.127) and the second is westwards (fig. 7.130). As one might expect both wards have many flows entering Greater London but there is an unmistakable skew for the north-eastern coastal towns in the first map. These are absent from the second example ward, which instead has a high proportion of flows intra-ward (36% - see fig. 7.129) followed by the 10-25km distance band (23%); the majority orientated towards the surrounding locales in central Kent. London is in the 50-100km band for all Ashford wards.

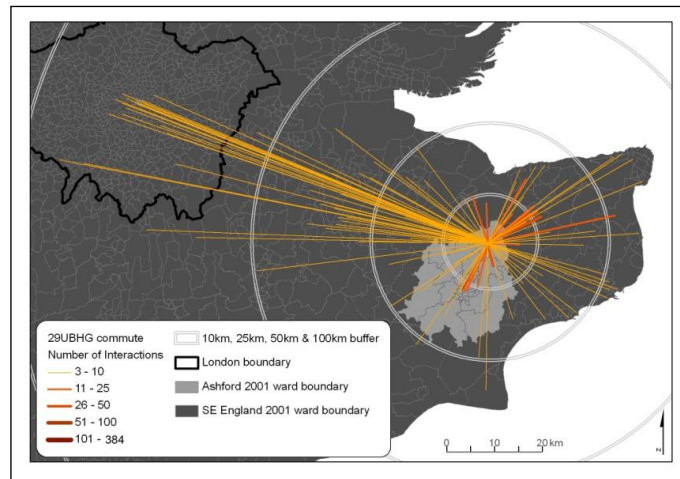
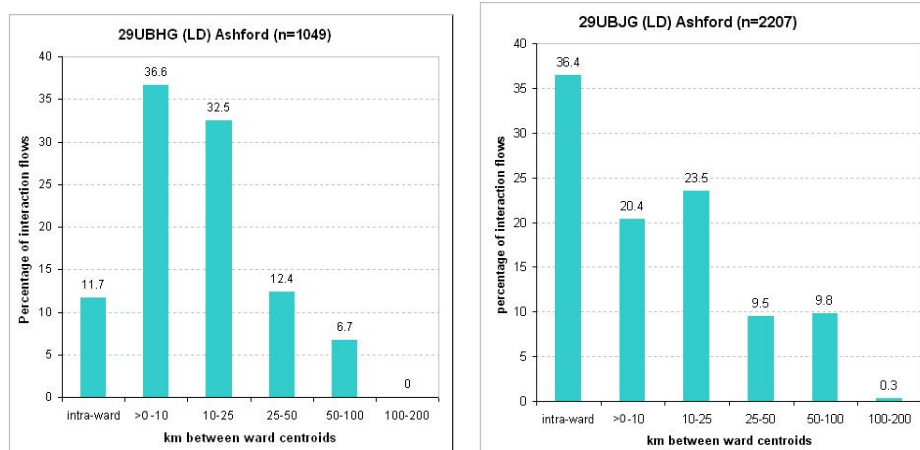


Fig. 7.127. Ashford least deprived ward example A (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

The combined least deprived distance bands in the graph below (fig. 7.131) illustrate the variety of the dispersal in the first three bands (intra-ward, 0-10km and 10-25km). One could hypothesise that the spatial location of the ward centroids' relative proximity to other major regional centres of employment (for example Maidstone or Gillingham, see appendix 10.13 for the overlay of all commuter interaction flows upon a rectified Google map) was the dominant dynamic.



Figs. 7.128 & 7.129: Ashford least deprived wards examples A & B (2001 Carstairs) distance bands

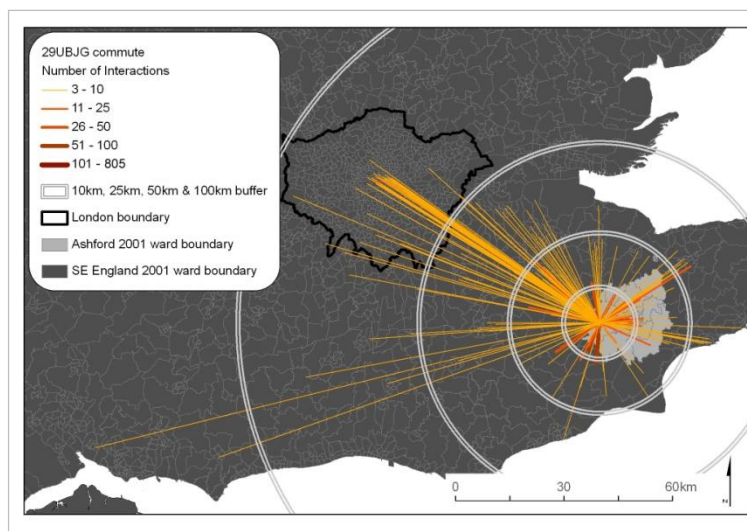


Fig. 7.130. Ashford least deprived ward example B (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

Ward 29UBJG is displaying a profile (fig. 7.131 in light blue) which suggests it is a result of the Modifiable Areal Unit Problem (MAUP). Here the 10km distance band cut-off for this ward is less than the point-to-point distance (cf. the actual road network/rail distance) between the centroids of the origin and the most popular working destination, central Ashford.

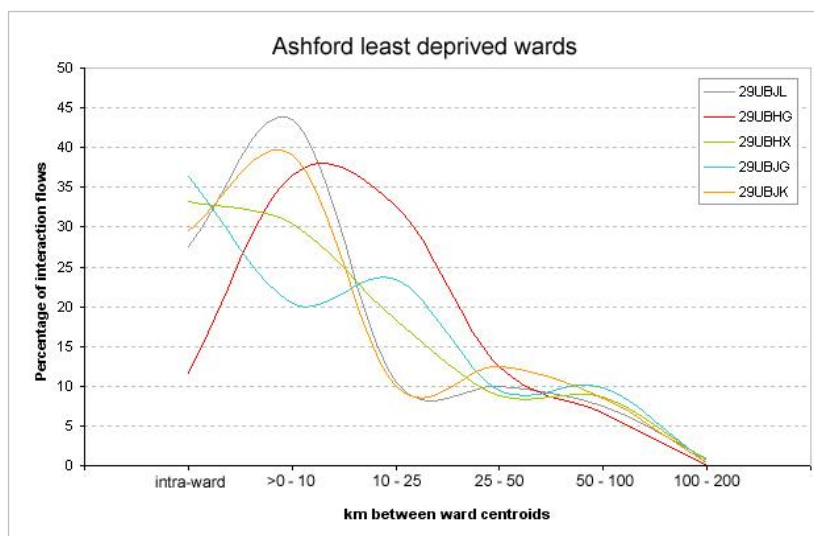


Fig. 7.131. Ashford least deprived ward (2001 Carstairs) combined distance band graph

Ashford: most deprived wards.

The five most relatively deprived (Carstairs Score 2001) wards in Ashford are clustered together in the centre of the analysis zone, all within 3km of the station. Their demographic diversity indices are relatively average for the analysis zone, from $1-D = 0.67 - 0.73$. From these ward centroids, London is also in the 50-100km distance band and no most deprived ward has over 6.2% of the commuting flows going that far (around 3-4% less than the least

deprived wards). The orientation of the commuting destinations are spread in 360° around Ashford, to all of the SE England coastline urban areas, with no one area clearly preferred over others (figs. 7.132 & 7.133, and the further three in the appendix 10.12).

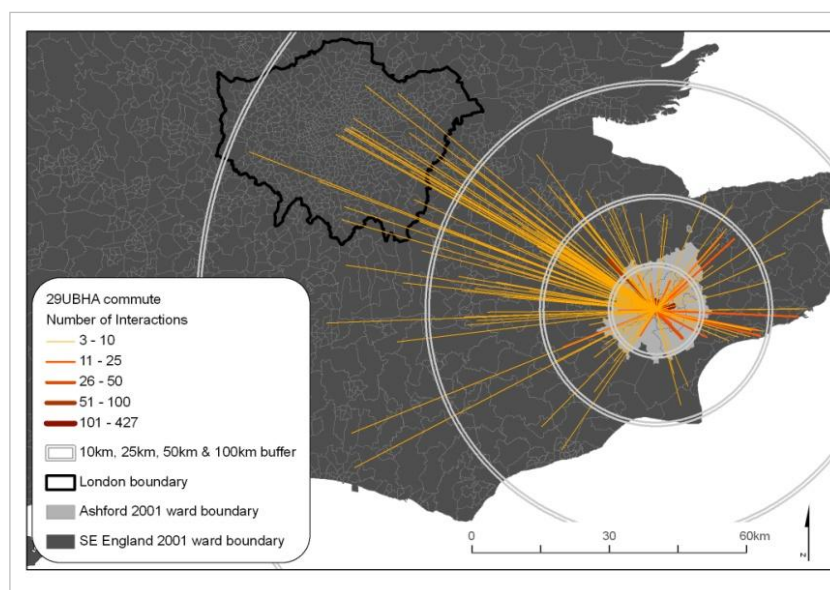


Fig. 7.132. Ashford most deprived ward example A (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

Compared to the least deprived, there are generally less intra-ward commutes, which is interesting given that the most deprived wards include the centre of Ashford and are densely inhabited, and the least deprived areas are more rural.

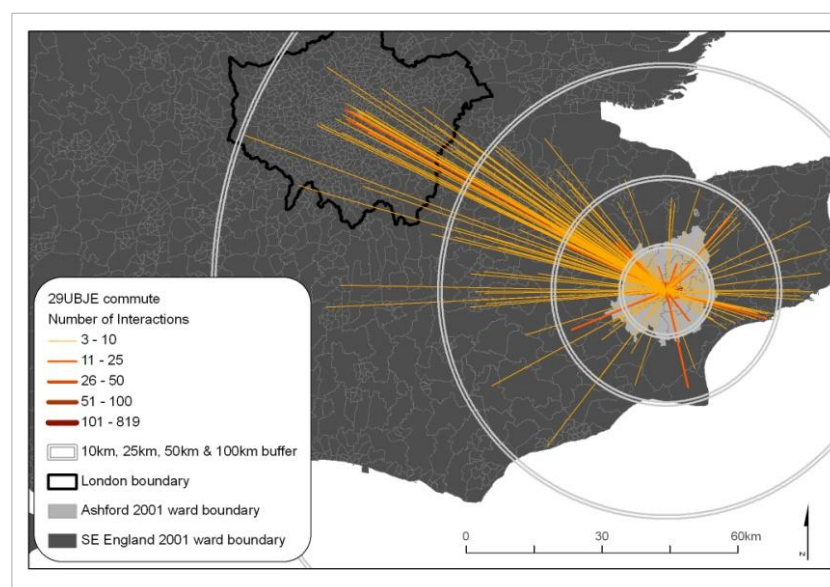
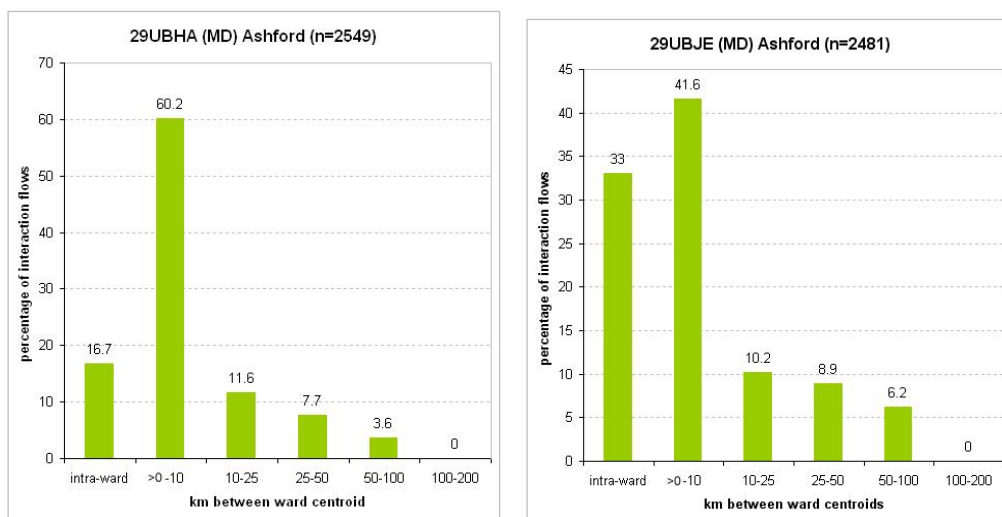


Fig. 7.133. Ashford most deprived ward example B (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

One can see from comparing two of the distance classes' vertical bar charts (figs 7.134 and 7.135) and the combined line chart below (fig. 7.136) that the five relatively most deprived wards share a very similar profile with the greatest variability occurring below 10km. The medium-long distances (around 25km onwards) tail off considerably, a faster decline than the least deprived wards.



Figs. 7.134 & 7.135: Ashford most deprived wards examples A & B (2001 Carstairs) distance bands

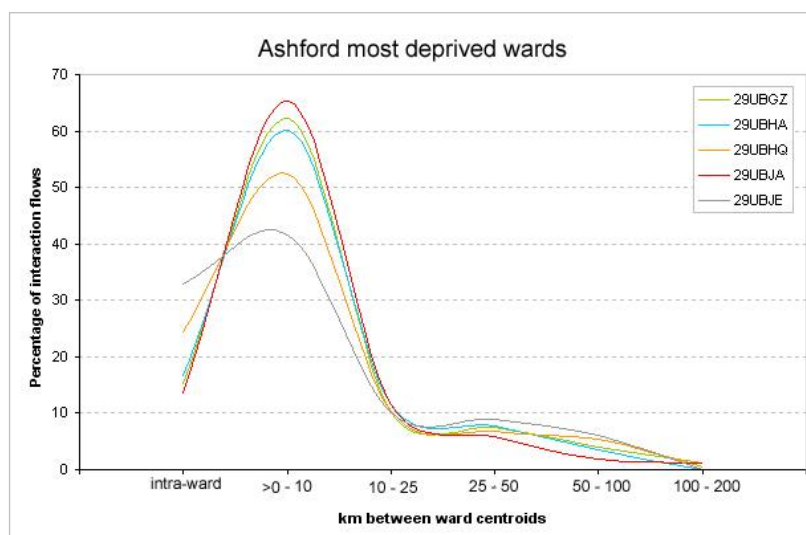


Fig. 7.136: Ashford most deprived ward (2001 Carstairs) combined distance band graph

Ebbfleet wards.

The Carstairs Score for 2001 quintiles once more result in the most and least deprived wards in contiguous areas (fig. 7.137) in Ebbfleet. The most deprived wards border the Thames riverfront and are mostly in central Gravesend, and the least deprived once more on the urban/rural fringe, with Dartford to the west, or completely rural.

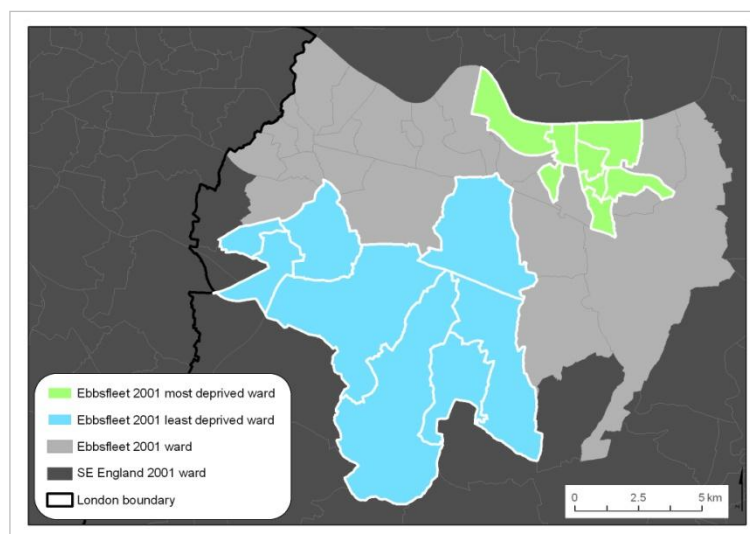


Fig. 7.137: Ebbsfleet most and least deprived wards (Carstairs Score 2001 quintiles) [Norman 2009 & 2001 Census ONS, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

The demographic (OAC 2001 group) for the eight least deprived wards is a mixture of mostly Agricultural and Village Life with some OAs of Blue Collar Worker and Settled Households with Prospering Older Families to the south (Diversity Index $1-D=0.72-0.82$, around average diversity for the 10km zone). For the least deprived wards, the centre of London falls into the 25-50km distance band which forms the second most popular destination for workplace trips, after Dartford or Gravesend for this group of wards (figs. 7.138 & 7.139, and see appendix 10.12 for other Ebbsfleet commuting journeys). Very few workplace flows extend beyond 50km for these wards (figs. 7.140 & 7.141), remaining very much within Kent, Surrey or Hampshire. Considerably fewer journeys are made to the coastal urban areas from here too.

Ebbsfleet least deprived wards

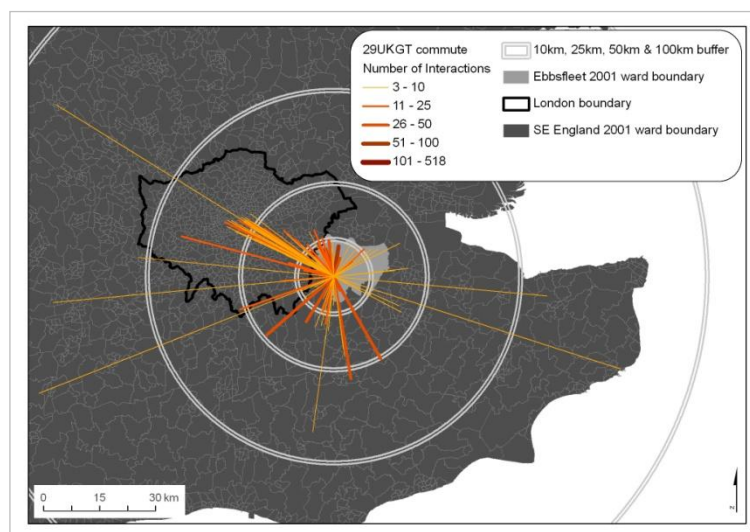


Fig. 7.138. Ebbsfleet least deprived ward example A (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

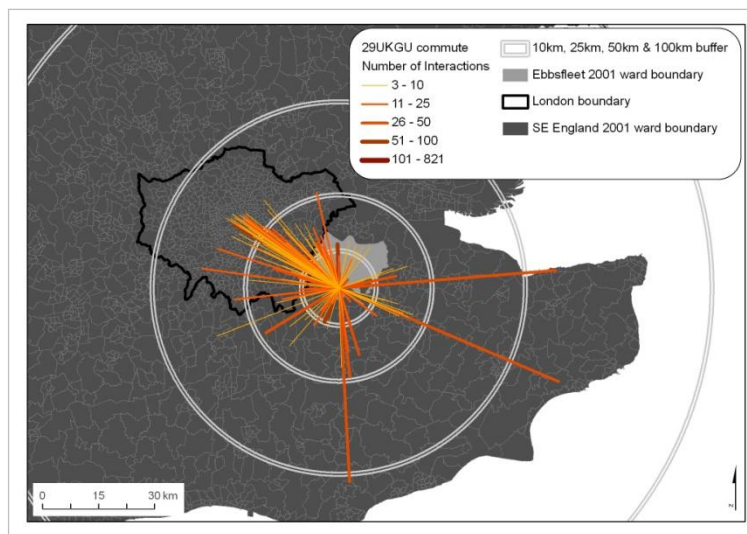
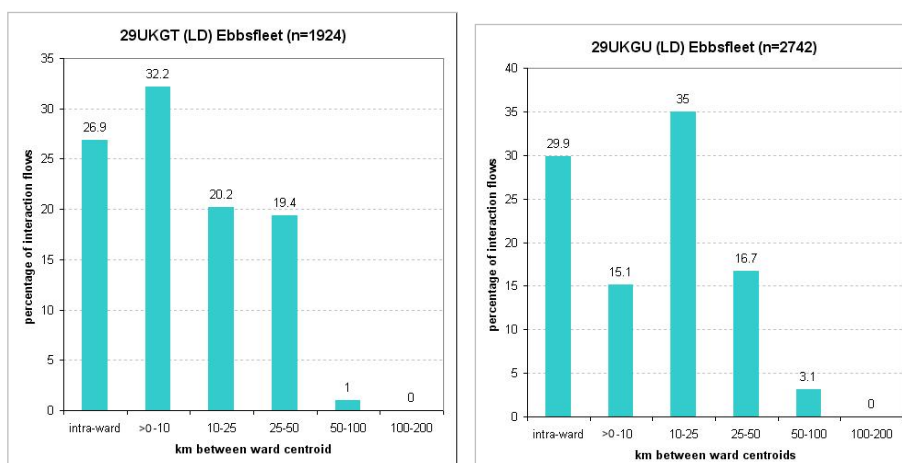


Fig. 7.139. Ebbsfleet least deprived ward example B (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R. & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]



Figs. 7.140 & 7.141: Ebbsfleet least deprived ward examples A & B distance bands

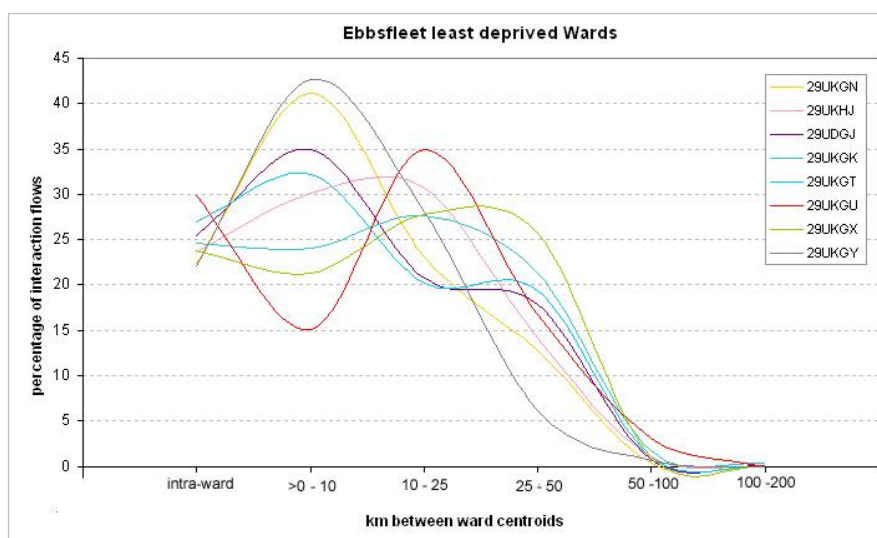


Fig. 7.142: Ebbsfleet least deprived wards (2001 Carstairs) combined distance band graph

The dip in >0-10km class for ward 29UKGU in red (fig. 7.142) is an example again of the MAUP described in a similar situation in Ashford (above). The Dartford central work area accounts for the high percentage of travel flows in the >0-10km class for the other seven least deprived wards. However it only measures 15% of total workplace flows for ward 29UKGU due to its relative geographical position, thereby skewing the overall mean for all the least deprived wards.

Ebbsfleet: most deprived wards

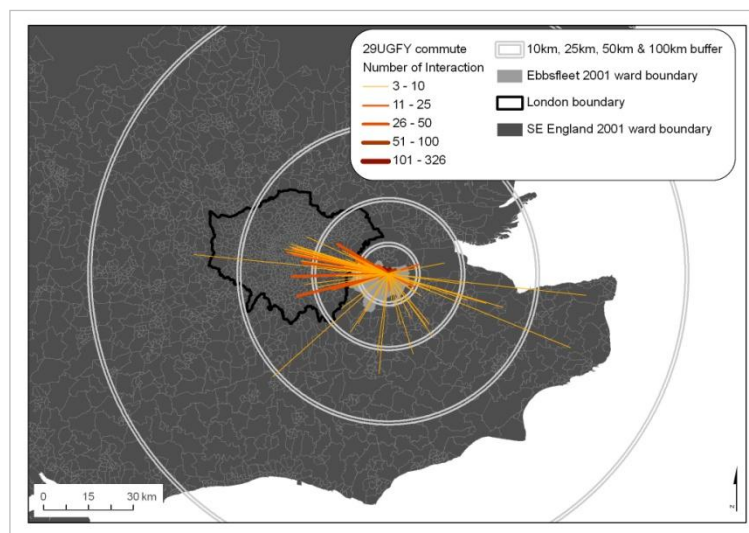
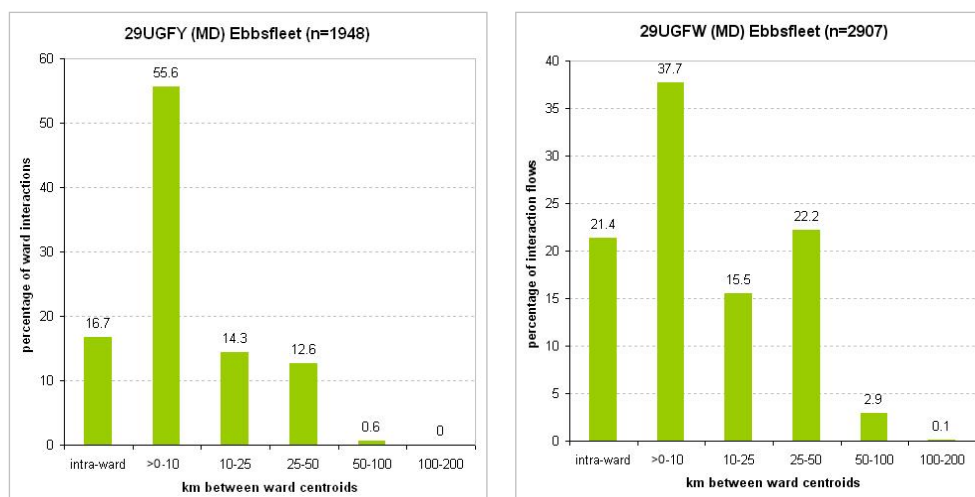


Fig. 7.143. Ebbsfleet most deprived ward example A (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

The eight relatively most deprived wards in the Ebbsfleet 10km analysis zone are all located in and around the Kent Thameside town of Gravesend. The demographic profile for the wards is highly mixed (five out of the eight wards have a diversity index of over 1-D=0.8), including Asian Communities, Settled in the City, Public Housing, Older Workers and Young Families in Terraced Houses. Nonetheless, all the wards have similar commuting patterns, with the greatest proportion orientated west either to Dartford (in the >0-10km band) or central London (25-50km) (figs. 7.143 and 7.144, and appendix 10.12 for the remaining six maps) accounting for the bimodality of the line graph for all relatively most deprived wards (fig. 7.145 below). Some wards show greater preponderance to have a more geographical dispersal of workplace flows (such as 29UGFW in fig. 7.146 below) but on the whole the destinations are more local than the least deprived wards.



Figs. 7.144 & 7.145: Ebbfleet most deprived wards examples A & B distance bands

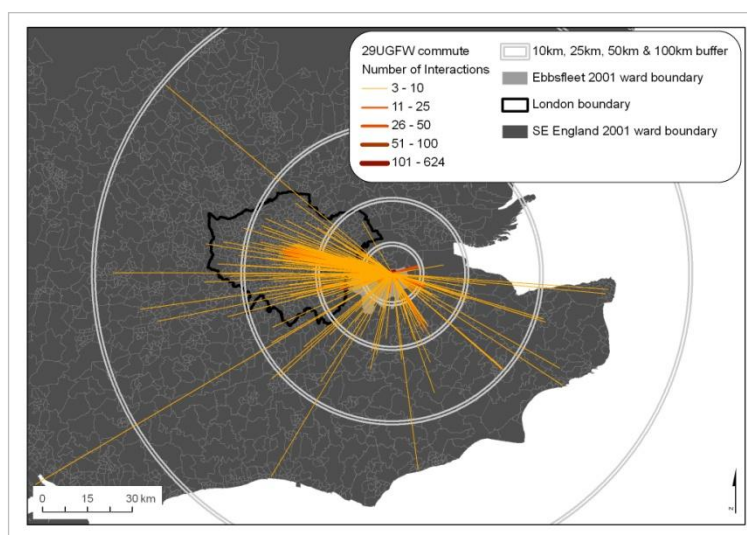


Fig. 7.146. Ebbfleet most deprived ward example B (2001 Carstairs) journey-to-work flows [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

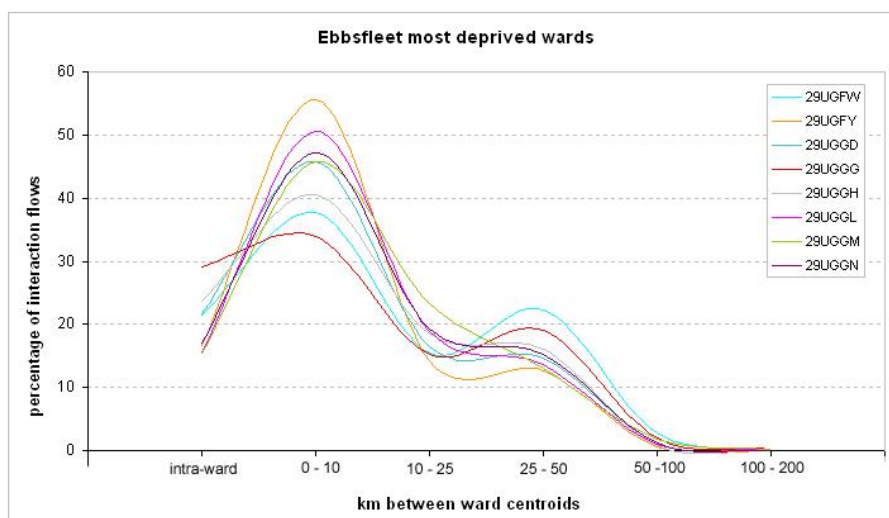


Fig. 7.147: Ebbfleet most deprived wards (2001 Carstairs) combined distance band graph

Testing for significance:

Are the differences between workplace flows significantly different that we can consider those living in the relatively least and most deprived areas to have differing patterns of commuting?

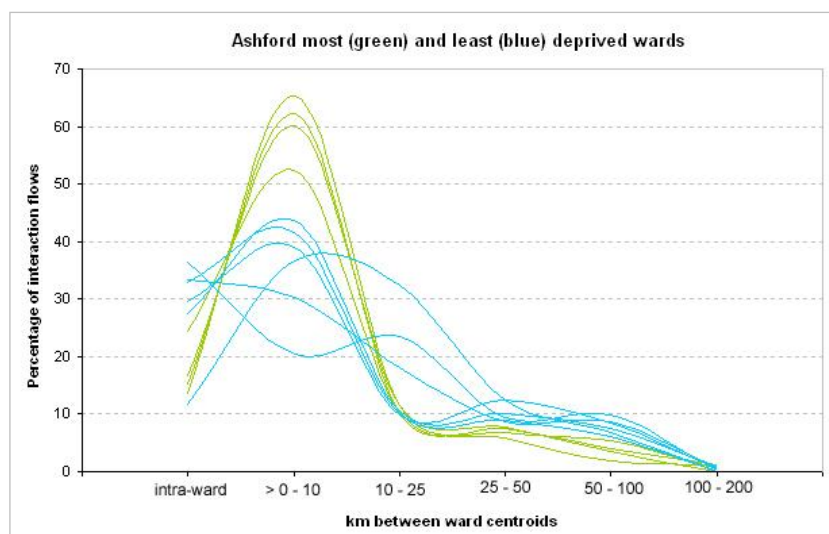


Fig. 7.148: Ashford most & least deprived ward (2001 Carstairs) combined distance band graph

The Kolmogorov-Smirnov (KS) test has no presumptions regarding the distribution of the data and gives us a metric that provides an intuitive and straightforward response to the query 'there is no difference between most and least deprived ward workplace flows, and the two sets of sample data come from identical populations'; our null hypothesis to explore these data, selecting a conventional significance level of $\alpha=0.05$ (full calculations are in appendix10.14).

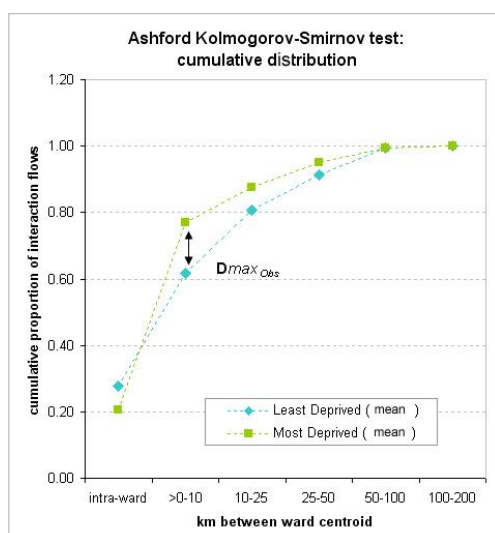


Fig. 7.149 (below): Cumulative distribution between most and least deprived commuter flows

Transforming the above line graph (fig. 7.148) to a mean for most and least deprived, then cumulative proportions, a difference becomes most apparent at the >0-10km band (fig. 7.149). This $D_{max_{Obs}}$ value of 0.15 is larger than $D_{max_{0.001}}$ at 0.051, making it significant at $p<0.001$. This is due to the relatively large sample size of workplace interaction flows ($n=1,769$ for least deprived, and $n=8,545$ for most deprived). From this we can reject the null hypothesis and propose that the workplace flows are not identical on average for

those who live in the relatively most and least deprived areas of Ashford. This of course is not to imply causality; that the deprivation level alone is responsible for this difference (or at least, it is not proven here). However, it provides a basis to understand the strengths of the

local transport infrastructure changes that the MUP can bring for the different wards around the station, along with a look at the patterns of mode from these different wards (see below).

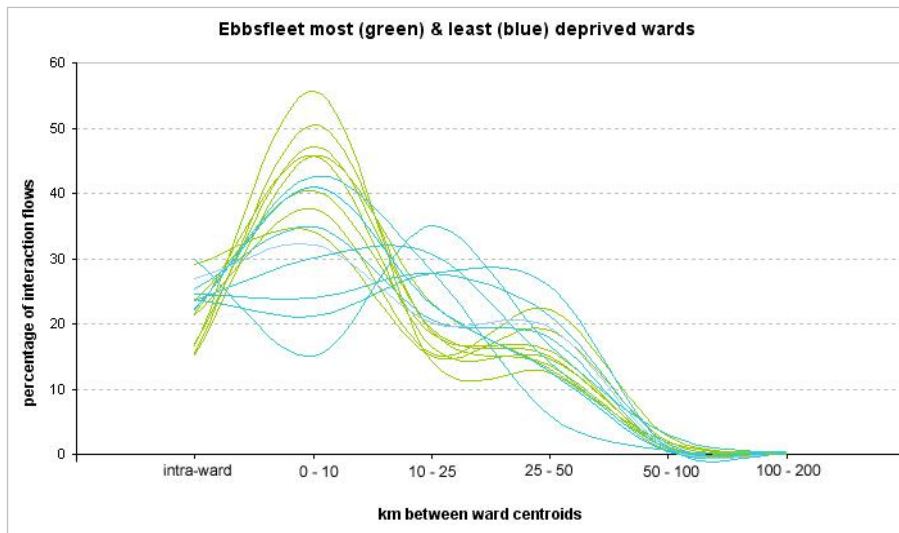
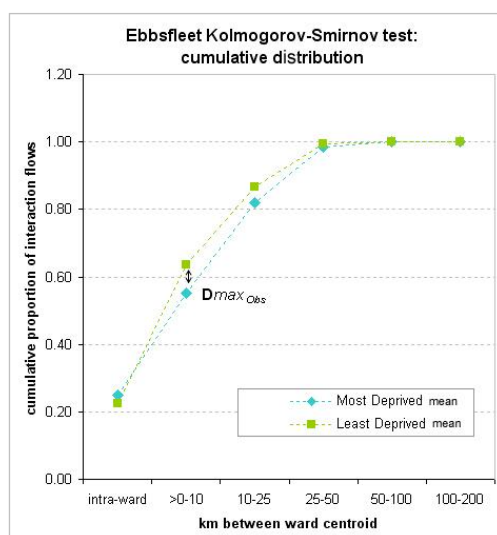


Fig. 7.150: Ebbsfleet most & least deprived ward (2001 Carstairs) combined distance band graph

Repeating the KS test for the Ebbsfleet dataset one could, given the more complicated pattern discernable in the fig. 7.150 above, presume that the geographical configuration of the wards and local/regional job opportunities reduced the strength of the assuming different commuting patterns for the most and least deprived wards. See appendix 10.14 for the calculations.

Fig. 7.151 (below): Cumulative distribution between most and least deprived commuter flows



Indeed the $D_{max_{Obs}}$ value here is 0.08, once again in the $>0-10\text{km}$ band (fig. 7.151) yet the large sample size of the workplace interaction flows ($n = 2,584$ for least deprived, $n=20,828$ for most deprived) results in this value being significant at $p<0.05$ (the $D_{max_{Obs}}$ value is greater than the $D_{max_{0.05}}=0.28$). We can again reject the null hypothesis and consider that the commuter flows are not identical, with the sample categorised in this way. It is likely that different distance bands would produce a different result, as would removing the least

deprived ward commuter flows (29UBJG in Ashford and 29UKGU in Ebbsfleet discussed above) that 'buck the trend'. Further rigorous testing would be needed before one could incorporate this firmly within a hypothetical indicator set, or its limitations better understood by the decision-makers.

The travel mode sub-indicator

Ashford wards

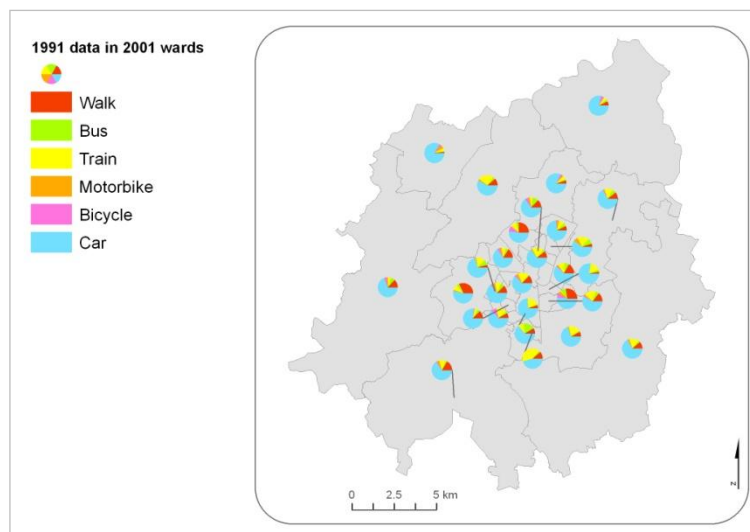


Fig. 7.152: Ashford 1991 mode data in 2001 ward definitions (all modes) [1991 Census: Special Workplace Statistics (Great Britain) UK Data Service Census Support & ©Crown copyright/database right 2011 Ordnance Survey/UK Borders]

Spatially joining and aggregating the 1991 ED population-weighted centroids and their values to the 2001 wards they fall within, gives us a roughly comparable dataset with which to consider the changes in trends over time regarding mode. Note again though that the 1991 data are at a 10% sample rate. Regrettably this is not a multi-modal census question, so only the primary (most distance covered) mode is known. For Ashford (fig. 7.152 above) already it is clear that car use dominates in all wards in 1991 save one where train use (in yellow) is substantial. Walking is a significant minority, even in some of the more peripheral (in the analysis zone) wards.

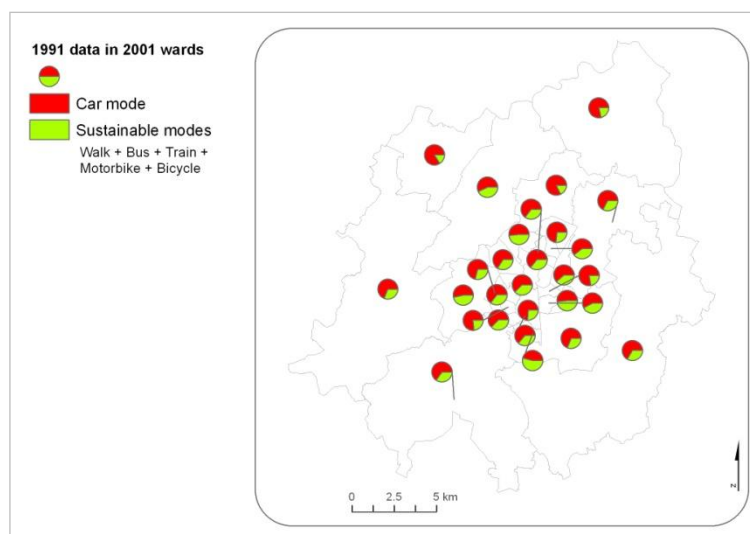


Fig. 7.153: Ashford 1991 mode data in 2001 ward definitions (sustainable vs. car) [1991 Census: Special Workplace Statistics (Great Britain) UK Data Service Census Support & ©Crown copyright/database right 2011 Ordnance Survey/UK Borders]

Combining all forms of non-car use journeys into a relatively 'sustainable' category, one has a clearer picture of the split (fig. 7.153), with car use dominating almost all wards, bar three where sustainable modes are roughly equal or in one case, dominating. None of these three wards are located in the heart of Ashford, but on the urban/rural fringe.

Replicating the maps for the 2001 census, at 100% sample rate (figs. 7.154 & 7.155 below), the use of the car as the primary mode increases across all wards, with walking becoming the second most common mode. It is far behind car use, mostly used in the more central wards but also in one outer more rural ward. Train use has fallen considerably relative to other modes and bus use as the primary mode is only notable in a couple of wards south of the main urban core.

The sustainable/car divide has therefore changed; car use dominates all wards, with some wards achieving only a maximum of 37% sustainable mode use across the zone (walking and train use accounting for this proportion). The inner 3km zone wards have mixture of increase and decrease in sustainable modes in the intervening ten years, which is explored in the percentage change maps below (figs 7.156 and 7.157).

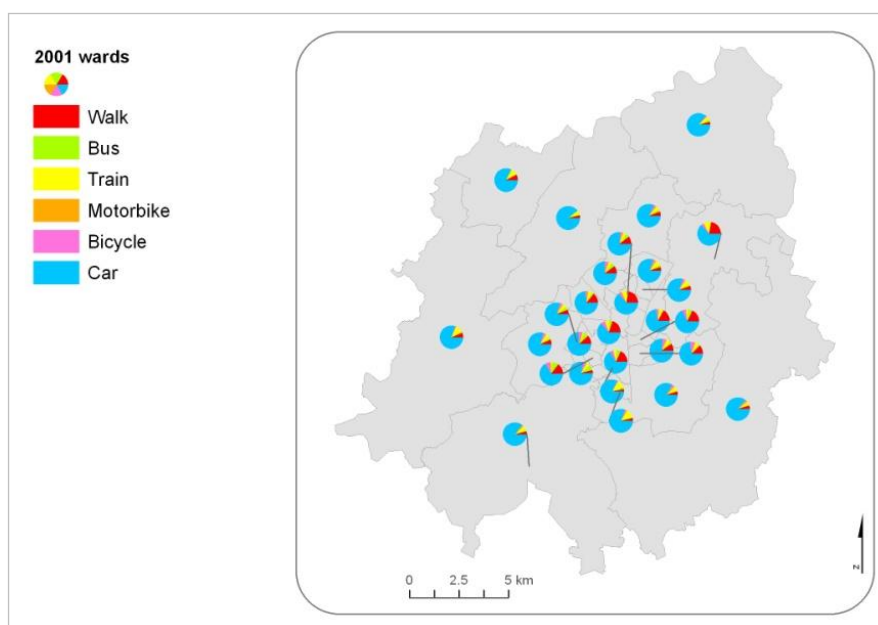


Fig. 7.154: Ashford 2001 mode data in 2001 ward definitions (all modes) [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

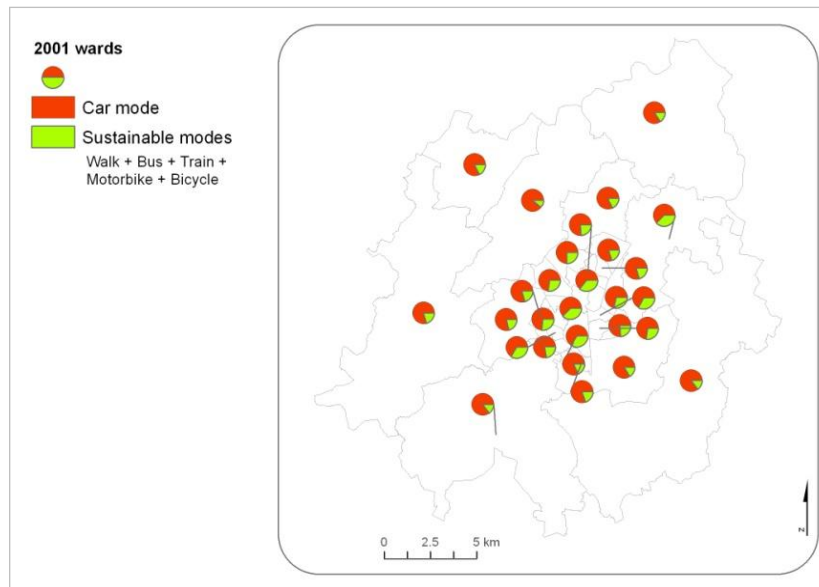


Fig. 7.155: Ashford 2001 mode data in 2001 ward definitions (sustainable vs. car) [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright /database right 2011 Ordnance Survey /EDINA]

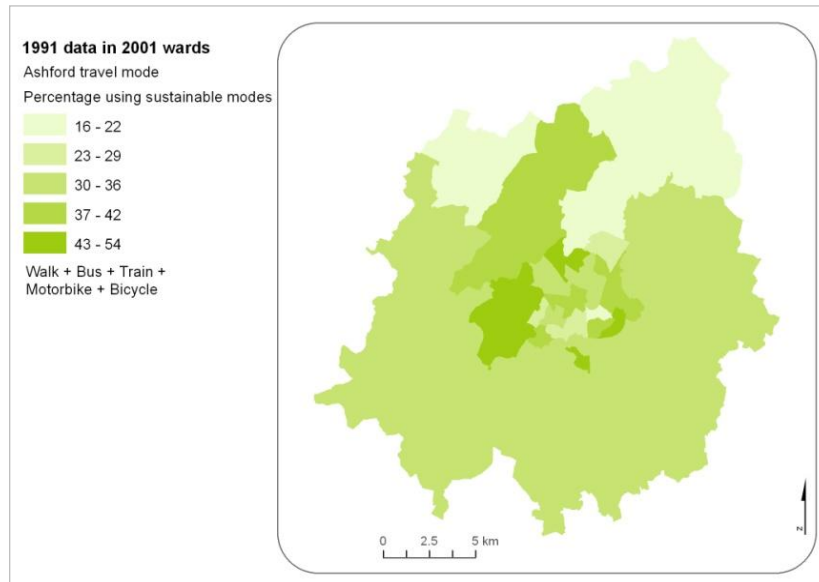


Fig. 7.156: Ashford 1991 mode data in 2001 ward definitions (sustainable mode percentages[1991 Census: Special Workplace Statistics (Great Britain) UK Data Service Census Support & ©Crown copyright/database right 2011 Ordnance Survey/UK Borders]

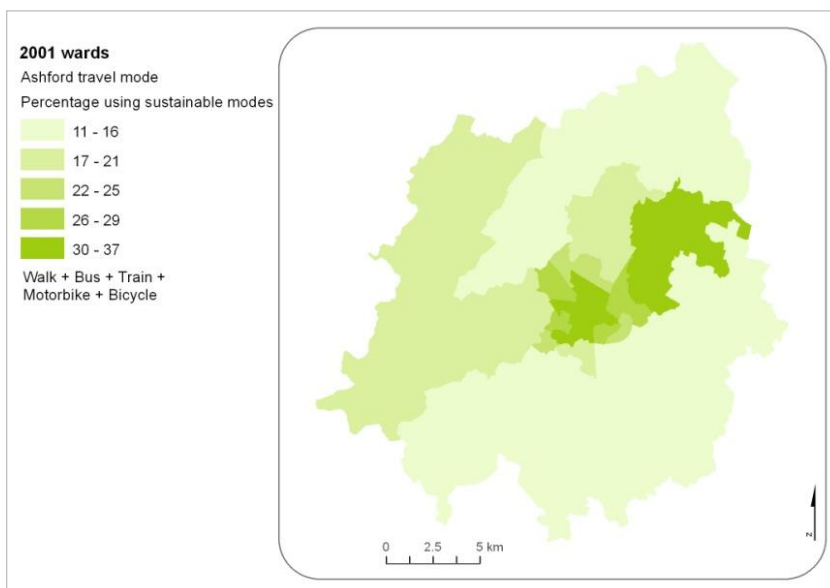


Fig. 7.157: Ashford 2001 mode data in 2001 ward definitions (sustainable mode percentages) [©Crown copyright/database right 2011 Ordnance Survey/EDINA]

These 'percentage of sustainable mode use' maps (figs 7.156 and 7.157) confirm that the wards with the highest sustainable mode use change, from those located in the urban/rural fringe in 1991, to urban core and one rural ward in 2001. The maximum percentage of sustainable mode use falls from 54% to 37% for the whole 10km analysis zone.

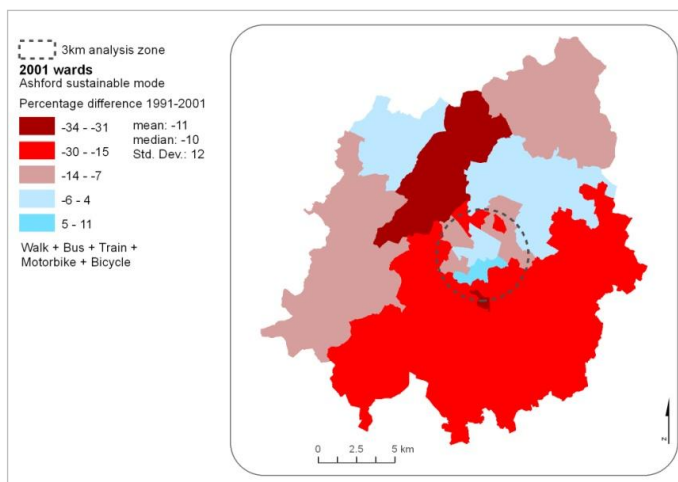


Fig. 7.158: Ashford percentage change between 1991 and 2001 data (sustainable mode) [1991 Census: Special Workplace Statistics (Great Britain) UK Data Service Census Support & ©Crown copyright/database right 2011 Ordnance Survey/UK Borders]

The above map (fig. 7.158) with percentage change quintiles in natural breaks (Jenks), along with the bar chart (fig. 7.159) below, illustrates the scale and spatial distribution of the rise of car use at the expense of more sustainable modes. One outer ward has a percentage fall of -34%, although the majority fall between -6% to -25% decreases in use, with a mean of -11% throughout the 10km analysis zone wards. Seven wards either change relatively little or have a positive percentage change, an increase in walking as the primary mode for all. This amalgamated mode map probably masks some interesting single mode patterns, but the method is obviously repeatable for the percentage change of an individual mode between 1991 and 2001.

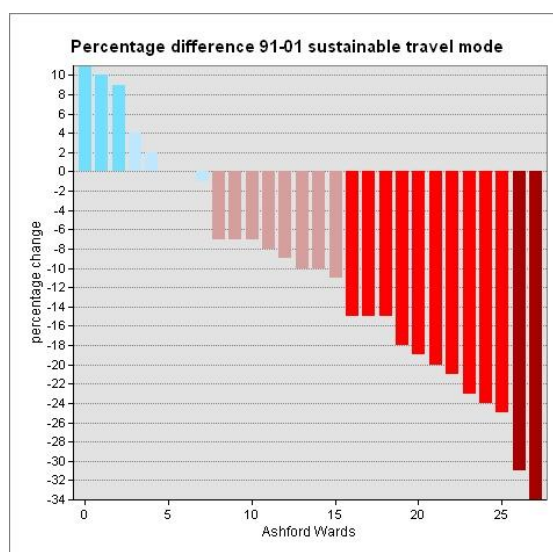


Fig. 7.159: Ashford percentage change between 1991 and 2001 data (sustainable mode)

Ebbsfleet modes

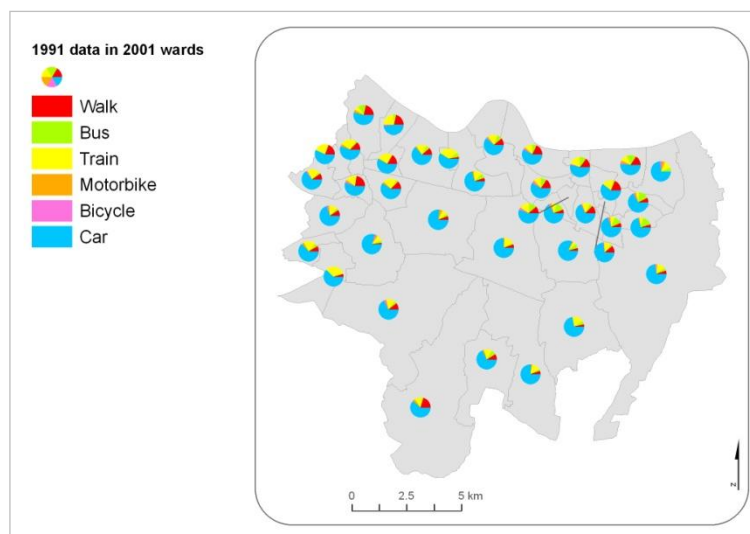


Fig. 7.160: Ebbsfleet 1991 mode data in 2001 ward definitions (all modes) [1991 Census: Special Workplace Statistics (Great Britain) UK Data Service Census Support & ©Crown copyright/database right 2011 Ordnance Survey/UK Borders]

Like Ashford, there are three wards (comprising aggregated 1991 ED data) that have approximately equal, or just above, non-car vs. car use, located in central Dartford to the west or central Gravesend to the east. In both cases there is not a single secondary mode that dominates, but a variety of mostly walking, train and bus usage. Patterns that are evident from scanning the map above (fig. 7.160) include the cluster of bus usage to the east in Gravesend, absent from Dartford, where train followed by walking (with relatively little bus usage) is suggested. Relatively little walking occurs in most peripheral wards except one ward to the south where it accounts for over 20% of all modes. Fig. 7.161 illustrates the proportions of sustainable modes versus car usage in 1991.

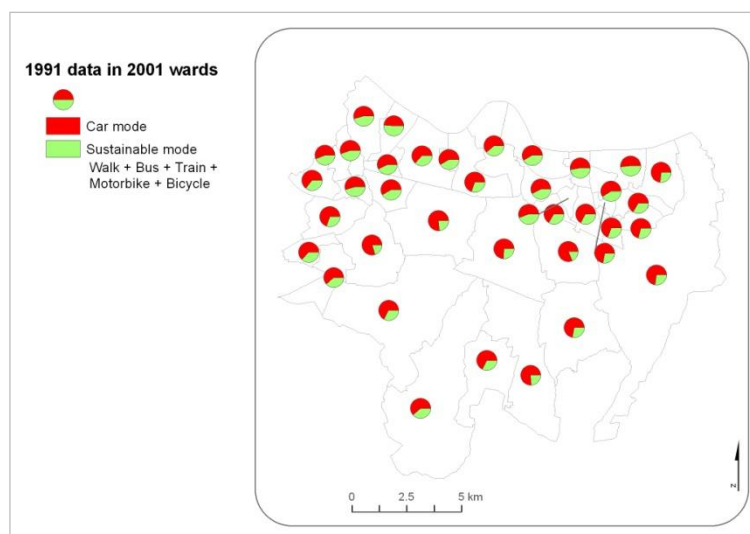


Fig. 7.161: Ebbsfleet 1991 mode data in 2001 ward definitions (sustainable vs. car) [1991 Census: Special Workplace Statistics (Great Britain) UK Data Service Census Support & ©Crown copyright/database right 2011 Ordnance Survey/UK Borders]

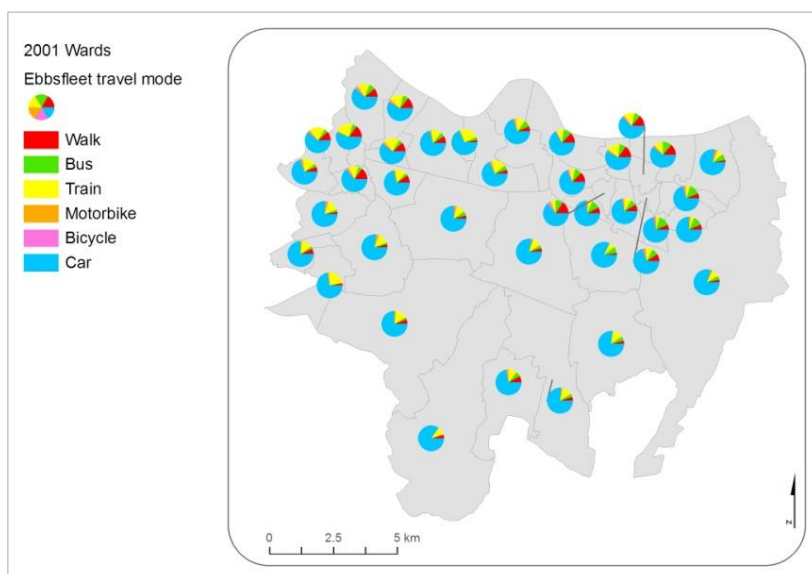


Fig. 7.162: Ebbsfleet 2001 mode data in 2001 ward definitions (all modes) [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

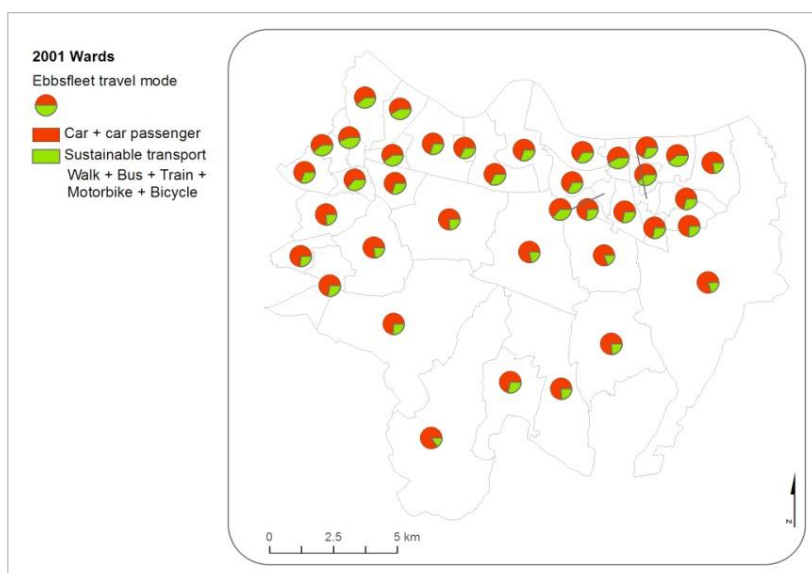


Fig. 7.163: Ebbsfleet 2001 mode data in 2001 ward definitions (sustainable vs. car) [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

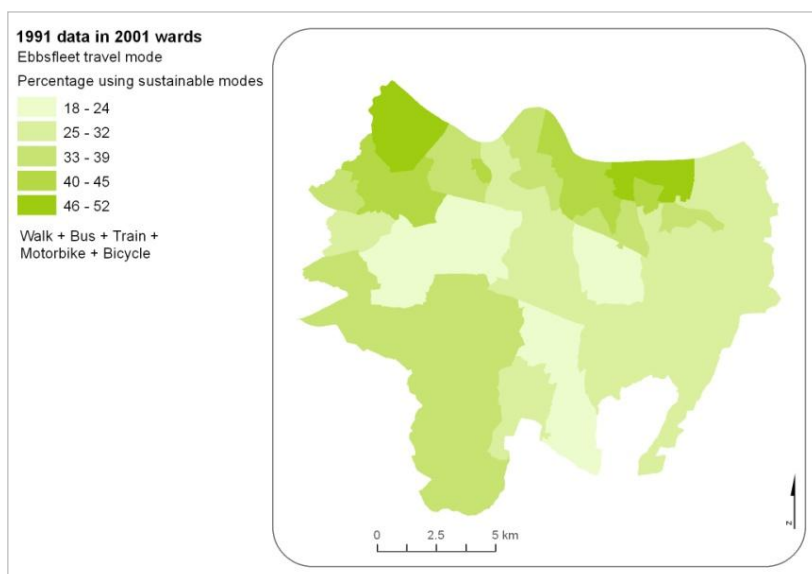


Fig. 7.164: Ebbsfleet 1991 mode data in 2001 ward definitions (sustainable mode percentages) [1991 Census: Special Workplace Statistics (Great Britain) UK Data Service Census Support & ©Crown copyright/database right 2011 Ordnance Survey/UK Borders]

Ten years later, no ward population uses sustainable mode more than, or even as much as the car for the primary journey to work. The maps above (figs. 7.162 and 7.163) suggest that car use is the dominant mode across the zone, but there still remains a split of higher bus use to the east in Gravesend, an area that contains the wards of highest relative deprivation for the 2001 Carstairs scores. Train usage remains the secondary mode in Dartford to the west with walking falling considerably in all areas but in the southern peripheral wards in particular.

Regarding the percentage of sustainable mode usage maps (figs. 7.164 & 7.165), unlike Ashford, the areas with the highest relative sustainable mode usage remain the same; wards bordering the Thames in Dartford and Gravesend. Beyond this there are fluctuations both positive and negative in the urban/rural fringe and rural areas, and in the relatively currently under-populated 3km analysis zone around Ebbsfleet station.

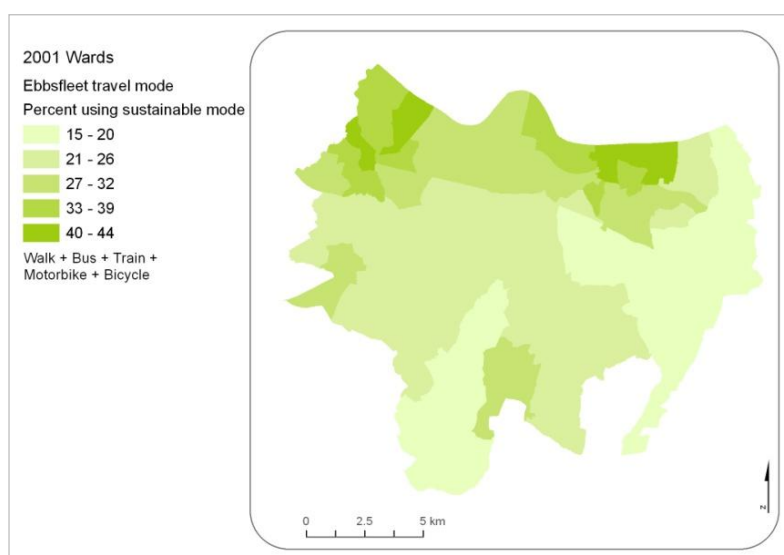


Fig. 7.165: Ebbsfleet 2001 mode data in 2001 ward definitions (sustainable mode percentages) [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

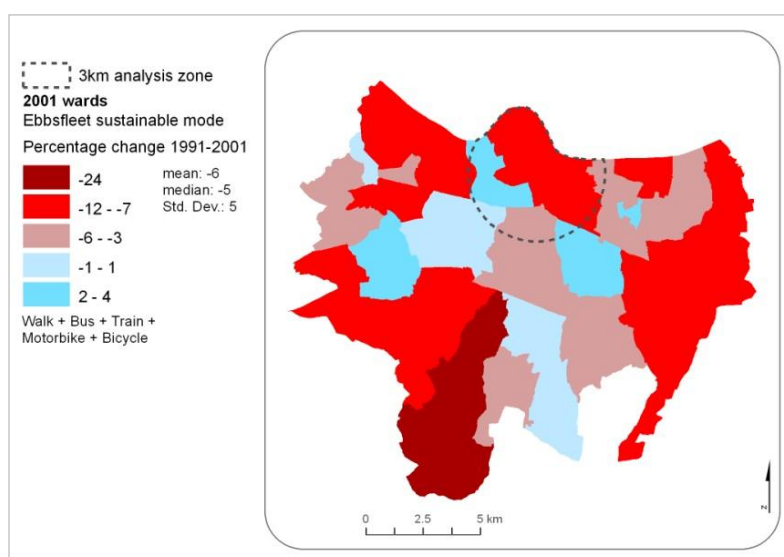


Fig. 7.166: Ebbsfleet percentage change between 1991 and 2001 data (sustainable mode) [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

For Ebbsfleet, the percentage change has a smaller positive and negative range (mean=-5), although the proportion remaining the same or improving is less than Ashford. Spatially, the improvements are dispersed in urban core (central Dartford and Gravesend), urban/rural fringe of Dartford and in rural areas (fig. 7.166). The greatest decreases are seen on the most peripheral, less densely occupied ward to the south, and moderate falls are equally seen in urban areas along the Thames riverfront. Fig. 7.167 confirms the extent of the rise and fall of sustainable mode usage.

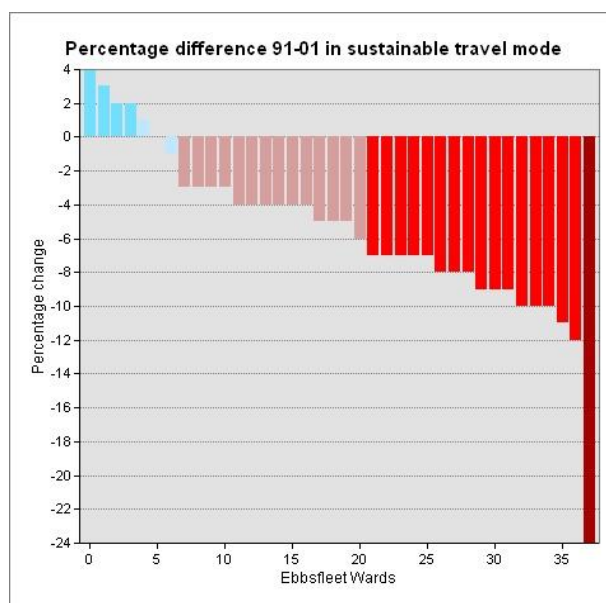
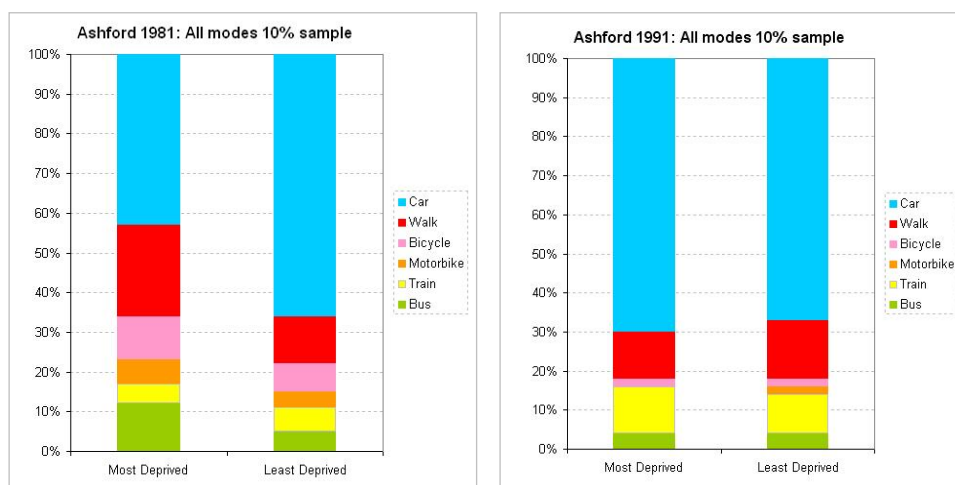


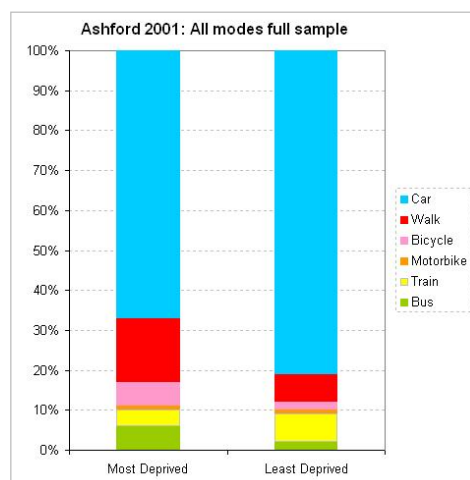
Fig. 7.167: Ebbsfleet percentage change between 1991 and 2001 data (sustainable mode)

Ashford Mode: differences between the most and least deprived quintiles 1981-2001



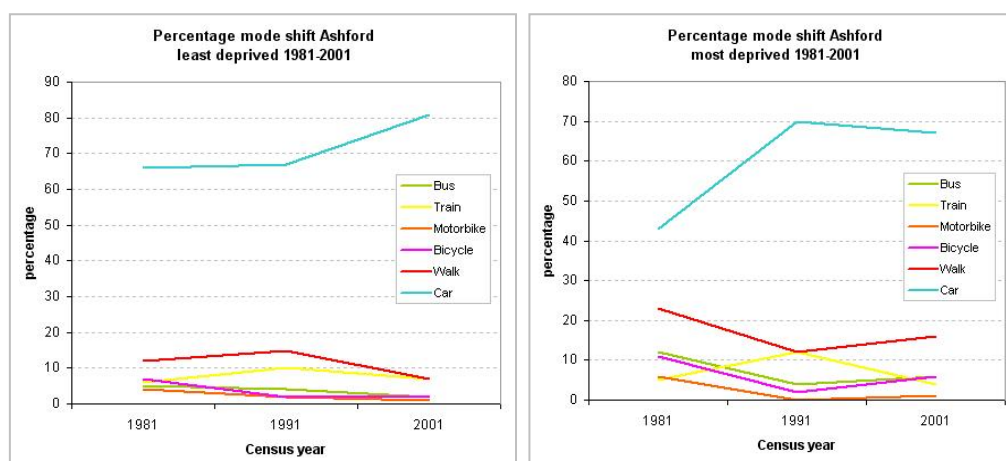
Figs. 7.168 & 7.169 (above): Ashford modes per decade (1981 and 1991 census)

Fig. 7.170 (below): Ashford modes per decade (2001 census)



As an addendum to the spatial sub-indicator maps above, a brief over-view of the differences in primary commuter mode usage between the most and least deprived (Carstairs Score) 1981 and 1991 Enumeration Districts (EDs) and 2001 Output Areas (OAs) is made (figs. 7.168-70). This is carried out without a spatial element due to the visual and computing complexity discussed in the previous section 7.5a). This section includes data from the 1981 census to contribute to the trend line graphs (figs. 7.171 and 7.172 below).

In Ashford, there was a significant disparity between the least and most deprived in the 1981 census, with over half of the latter utilising relatively sustainable modes over car (fig. 7.168). Walking and cycling were also common, with relatively high bus usage and other modes approximately the same. Ten years later and the most and least deprived are very similar (fig. 7.169), with slightly more train use in most deprived and slightly more walking in least deprived, which is moderately unexpected given the overall commuting patterns noted above. In 2001 this latter trend reverses (fig. 7.170), with walking more prevalent in most deprived than least deprived and a higher proportion of train usage in least deprived than most deprived. Bus use is around 5% more popular in the most deprived areas.

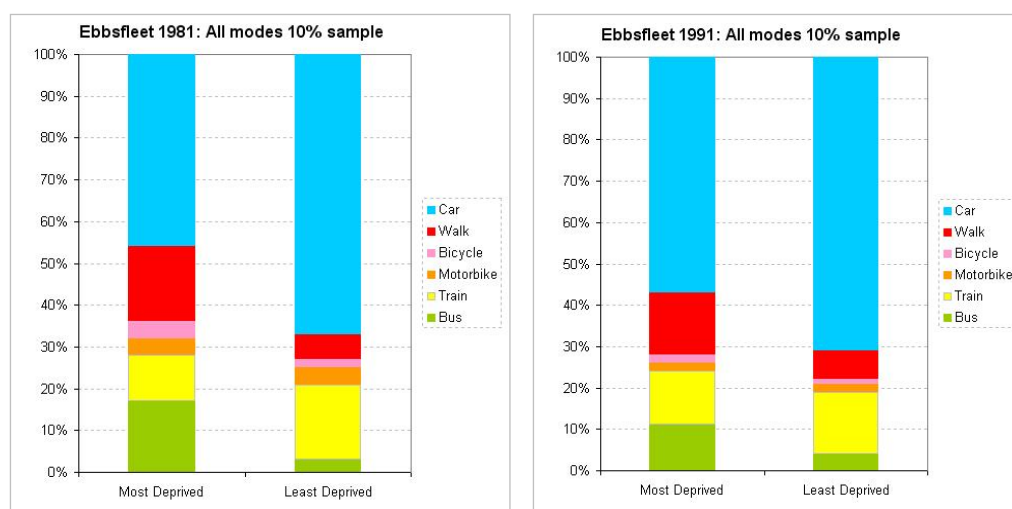


Figs. 7.171 & 7.172: Trend lines for least and most deprived EDs / OAs in Ashford 1981-2001

The trend line for Ashford's least deprived areas over the last 3 censuses (fig. 7.171), clarifies the extent that car use has risen whilst other modes have declined, some since 1981 (bicycle and motorbike), and other modes since 1991 (walking, train and bus). Two-wheeled

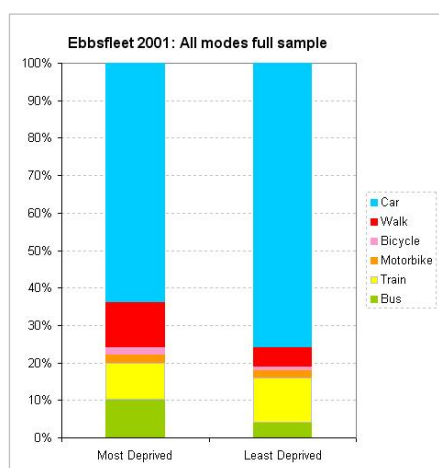
travel has continually been very low usage primary mode in these EDs and OAs. In the most deprived areas in fig. 7.172 these EDs and OAs demonstrate a small decrease in car use between 1991 and 2001, with a moderate increase in all other modes except train usage, even though it had seen a steady increase in mode proportion between 1981 and 1991. Walking remains the second most popular mode in both most and least deprived areas of Ashford in the three censuses.

Ebbsfleet Mode: differences between the most and least deprived quintiles 1981-2001

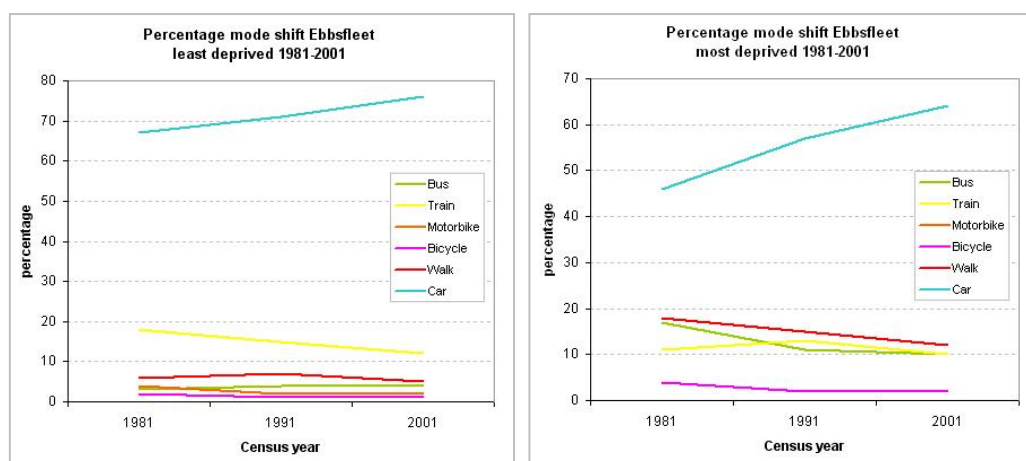


Figs. 7.173 & 7.174 (above): Ebbsfleet modes per decade (1981 and 1991 census)

Fig. 7.175 (below): Ebbsfleet modes per decade (2001 census)



In Ebbsfleet, the level of car use remains higher in the least deprived than most deprived areas in all three censuses (figs. 7.173-75), with roughly equal bicycle and motorbike use in both sets of EDs / OAs. Bus use is noticeably higher in the most deprived over the least in 1981 and this becomes less pronounced over the years. Train use is similarly more common in the least deprived areas over the most deprived, 18% more usage in 1981, but only 5% more by 2001. Walking is a common mode for all areas throughout the three censuses, but unlike Ashford, it is more dominant in most deprived wards throughout the three censuses.



Figs. 7.176 & 7.177: Trend line for least and most deprived EDs / OAs in Ebbsfleet 1981-2001

The trend lines for Ebbsfleet's least deprived EDs and OAs (fig. 7.176) reveals that car use has steadily risen at a steady pace as the second most common primary mode, train, has decreased. The remaining forms of transport mode have hardly changed over the three decades, although bus use has increased a little.

In the most deprived areas (fig. 7.177) car usage has risen much more sharply although still a lesser proportion of all modes than in the least deprived and all other modes decrease. Bus usage remained mostly steady (at c10%) between 1991 and 2001 as does cycling and motorbike (hidden beneath the cycle trendline) usage at c2.5%.

Given national, regional and local aims to achieve regarding the increase in sustainable mobility and car use reduction (for example the DETR White Paper 1998), it is evident that Ashford and Ebbsfleet both have a base of relative high car use. All other modes sampled are falling except for Ashford most deprived EDs and OAs in 2001. Planners and decision-makers will be interested to assess the effects of Fastrack and SmartLink feeder services and HS1 (the CTRL domestic service), as would the impact of the transport infrastructure changes that have occurred along with the MUTP's delivery. For example at Ebbsfleet, 9,000 car parking spaces have been created as a parkway from the M25 for the CTRL / HS1 service. Would this further encourage car-use from the London-bound commuters (or international passengers) from the least deprived wards in the area? Ashford however has several smaller park-and-ride services planned for CTRL passengers, riding on the planned SmartLink bus-service to the train station. Both of these impacts however would not be collected in the 2011 census, since the travel-to-work question remains uni-modal.

Mode and accessibility changes from MUTP feeder services

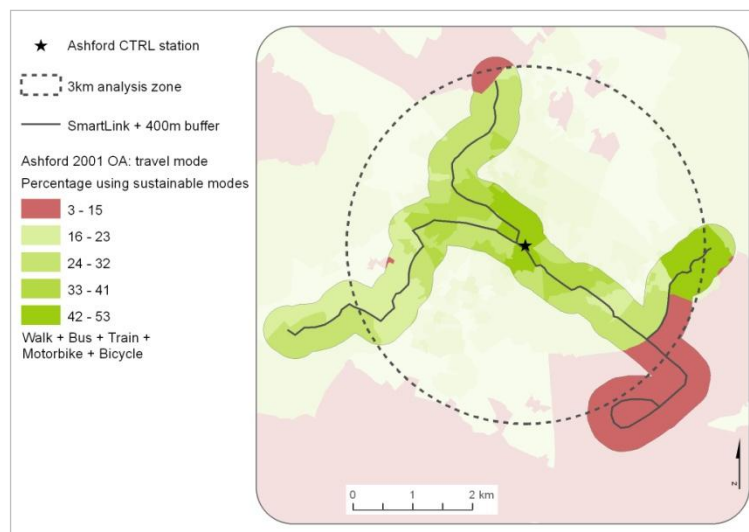


Fig. 7.178. Ashford 2001 OAs: SmartLink 400m buffer and sustainable mode usage 2001 [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

Exploring the SmartLink route and the percentage usages of sustainable modes (fig. 7.178), the bus passes through Output Areas that have medium to high usage of non-car modes for the journey to work. It also passes through some OAs that are high in car use (shaded in red), that planners could target to improve the uptake of the bus-service and reduction in car usage.

The potential ridership within 400m of the SmartLink bus route in Ashford covers wards that have both increased in sustainable mode use, and several that have decreased between 1991 and 2001 (fig. 7.179 below). The bus route extends beyond the most deprived wards, therefore the pattern of commuter OD workplace flows has not been studied for this sub-indicator. However, it is possible that the SmartLink route can provide a useful service to local commuters into central Ashford or medium-long distance commuters to other destinations reachable via the train network.

In Ebbsfleet (fig. 7.180 below), the MUTP feeder service Fastrack B between Dartford and Gravesend via the CTRL station, winds its way through Output Areas that have relatively high bus use already, but it also covers small pockets of very low bus use. Further exploratory mapsets would be needed to indicate if the population of those OAs walk, cycle or drive instead. The final map (fig. 7.181 below) suggests that the majority of OAs reduced the proportion of sustainable mode journeys to work between 1991 and 2001 and hopefully the aims of the MUTP feeder and the CTRL together will encourage the population from these OAs out of their cars.

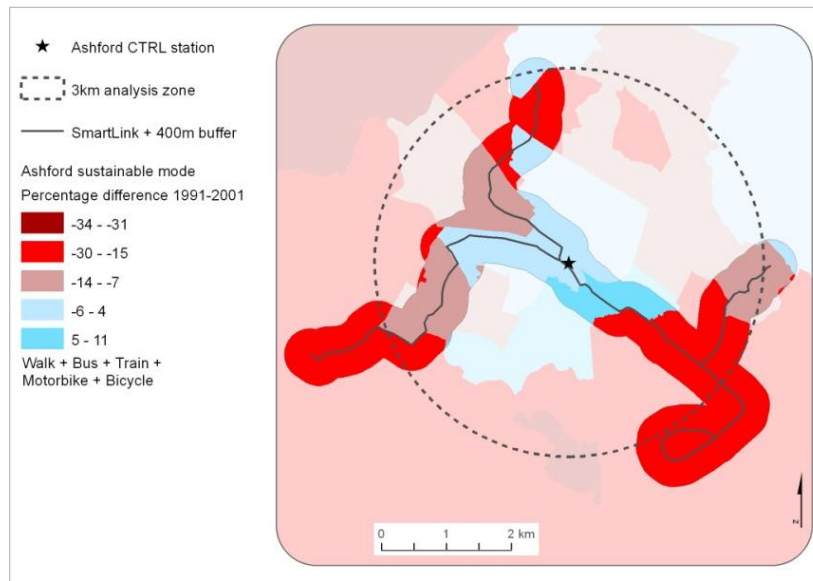


Fig. 7.179: Ashford 2001
OAs: SmartLink 400m
buffer and sustainable
mode percentage change
1991-2001 [2001 Census,
Special Workplace
Statistics C.I.D.E.R &
©Crown
copyright/database right
2011 Ordnance
Survey/EDINA]

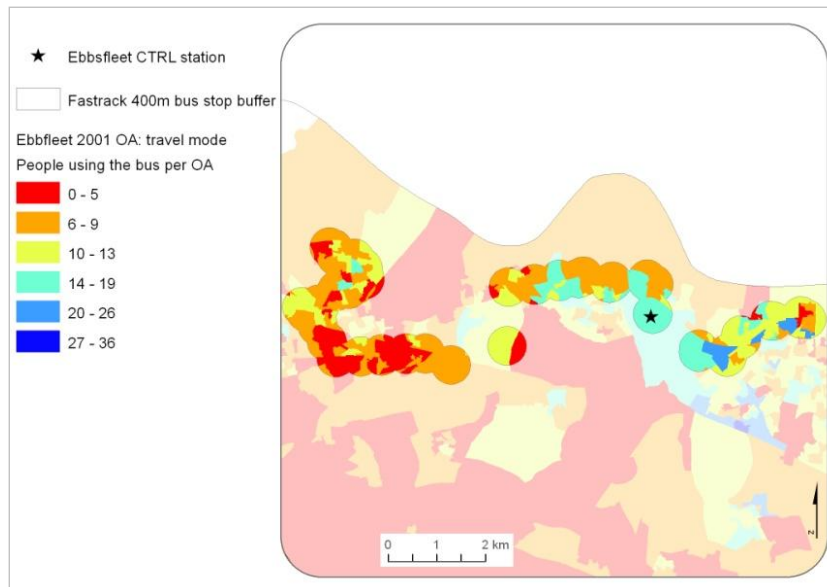


Fig. 7.180: Ebbsfleet 2001
OAs: Fastrack B 400m
buffer and bus usage 2001
[2001 Census, Special
Workplace Statistics
C.I.D.E.R & ©Crown
copyright/database right
2011 Ordnance
Survey/EDINA]

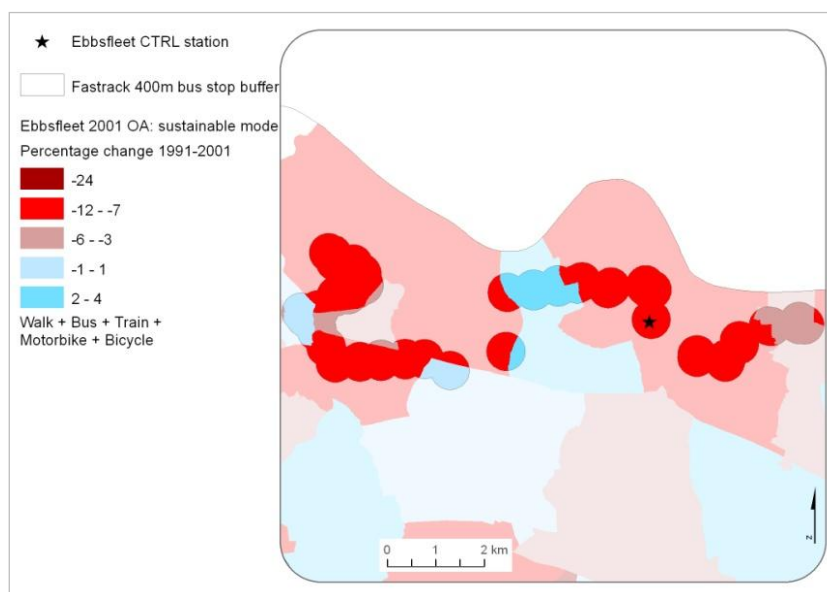


Fig. 7.181: Ebbsfleet 2001
OAs: Fastrack B 400m
buffer and sustainable
mode percentage change
1991-2001 [2001 Census,
Special Workplace
Statistics C.I.D.E.R &
©Crown
copyright/database right
2011 Ordnance
Survey/EDINA]

Ashford modes: the SuperSegment typology

The reclassification of the Output Area Classification groups by Steer Davies Gleave (Duckenfield 2009) aims to categorise output areas by typical traits that define a relative need for public transport, based primarily on bus utilisation (see the Accessibility Measure methodology for full explanation 7.3a).

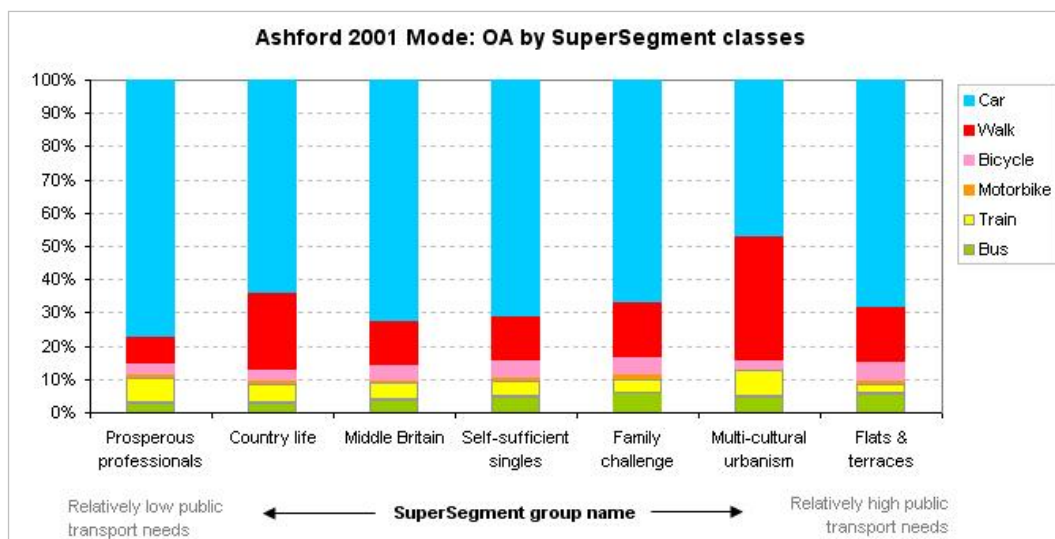


Fig. 7.182: Ashford 3km zone: percentages of mode usages from 2001 census by SuperSegment typology

For Ashford's central analysis zone, the highest proportion of bus ridership is at 6% for Flats and terraces (with the highest need) and Family challenge (third highest need), although the remaining groups have between 3% and 5%, which is not much lower (fig. 7.182). Only Multi-cultural urbanism OAs have over 50% sustainable mode usage (although only 13% is either bus or train). Yet given their central urban location and generally high level of relative deprivation (cf. relative deprivation map in section 7.2, figs. 7.18 and 7.19) it is perhaps to be expected that walking is the highest here, nearly equal to car usage. Train usage is highest in this group too (at 8%) followed by Prosperous professionals (7%), with the lowest train usage measured for Flats & terraces (3%) and the remaining groups at around 4-5%. Car use is high throughout the area as expected from the preceding assessments, but it is most high with Prosperous professionals (78%) and Middle Britain (73%) both of which have low public transport needs. Motorbike usage is 1% for all classes except Multi-cultural urbanism (0%), whilst cycling is the primary mode for choice for 6% of Flats & terraces, and either 3% or 5% for the remaining groups.

Ebbfleet modes: the SuperSegment typology

The spatial dispersal of the various SuperSegment classes is divided around the horizontal centre of the 3km zone (above and below the A20 dual carriageway: fig. 7.183). Groups typically of above national average public transport need (Flats & terraces, Multi-cultural urbanism, and Family challenge) primarily located north of the zone, coinciding with the urban areas of western Dartford and eastern Gravesend. Those of average needs (Self-

sufficient singles) are distributed throughout, and below average public transport needs to the south, in the more rural OAs. Multi-cultural urbanism is concentrated greatly in the east whilst the largest proportion of classes, Family challenge (25% of all OAs) surround the 'Prospering professional' class of the planned development of Ebbsfleet Valley.

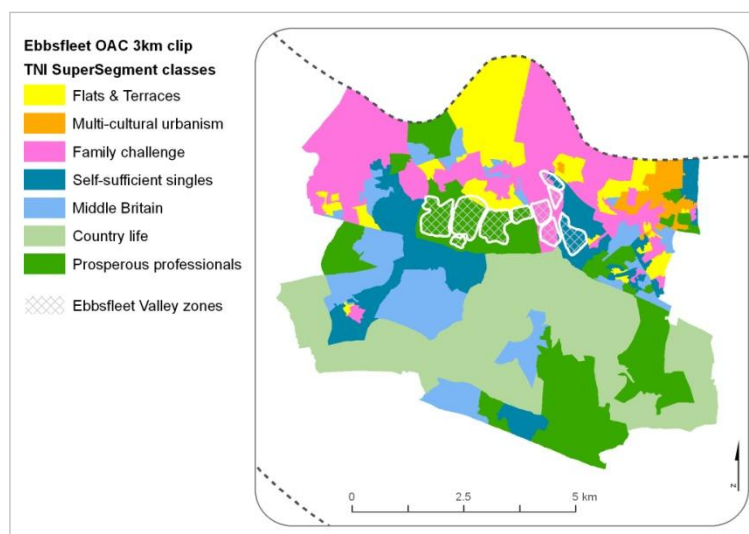


Fig 7.183: Ebbsfleet 3km analysis zone SuperSegment typology [Duckenfield 2009, 2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

The mode usages by each SuperSegment class (fig. 7.184 below) shares some similarities with the Ashford data; high train use (12%) and walking levels (15%) for Multi-cultural urbanism, high car use for Prosperous professionals (74%). A higher proportion, 82%, of Country life OAs utilise the car. Here the bus usage correlates approximately with the suggested level of need for public transport, although train use is as high for Prosperous professionals as it is for Multi-cultural urbanism (12% each). Walking also correlates with public transport needs (those with the most need, walk the most, and vice versa for those with the least relative need). Both bicycles and motorbikes have low usage between 1-2% for all classes.

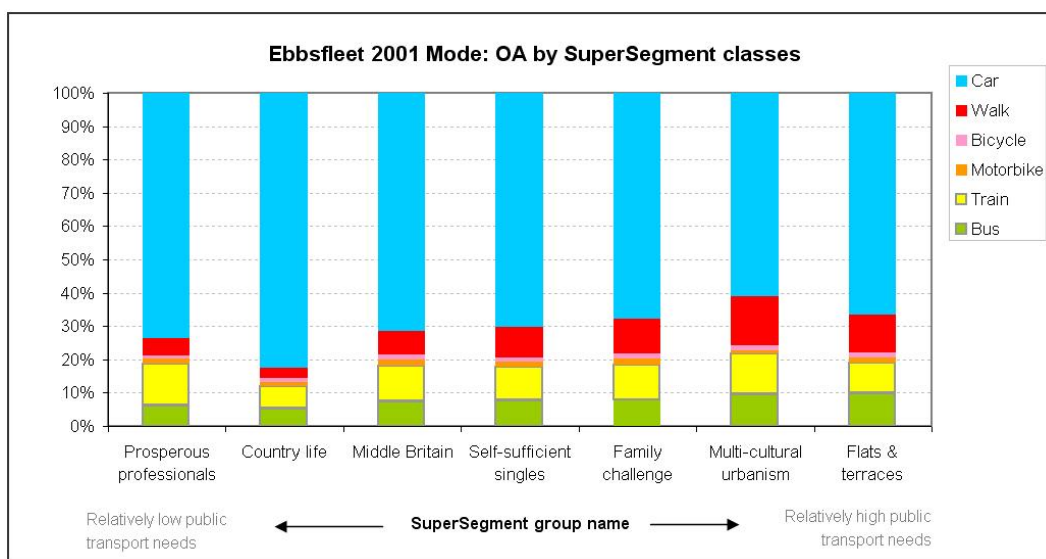


Fig. 7.184: Ashford 3km zone: percentages of mode usages from 2001 census by SuperSegment typology

7.5c

The Journey to Work indicator:

Findings

Journey to work indicator aim

This indicator aimed to help planners ascertain the local travel to work patterns and a baseline of transport modes used so as to facilitate appropriate MUDP-related transport changes to encourage less car use for all distances of commutes.

The workplace flows between ward centroids

Understanding where and how people are travelling to work everyday is critical information for transport planners at every government level, particularly since the emergence of the sustainability agenda in the 1980s. Tying in with Kent County Council's Local Transport Plan (K.C.C. 2006), reducing car use and encouraging more sustainable modes are explored albeit between 1991 and 2001, before and after the MUDP's delivery in Ashford, but before the CTRL / HS1 delivery in Ebbsfleet. The exploration of these datasets was at ward level, restricted to the most and least deprived wards (2001 Carstairs Score). Whilst a simple significance test (Kolmogorov-Smirnov) suggested that on average, wards of different deprivation levels had significantly different workflow commuting patterns, the approach had several shortcomings. These include measuring from a population-weighted ward centroid to centroid clearly makes the current analysis distance bands spurious, some intra-ward distances would no doubt be further than some inter-ward distances between dwelling origins and work destinations either side of a ward border. Also this approach is susceptible to problems associated with the Modifiable Areal Unit Problem (MAUP) discussed above, particularly for least deprived wards (see figs 7.131 and 7.142). However the sample sizes are large enough that it is fairly likely that the pattern is essentially a real one. Elements of note include the greater preponderance for least deprived, mostly rural wards to commute intra-ward nearly 10% more on average than relatively more deprived urban wards in Ashford, but only 3.5% more in Ebbsfleet (see figs. 7.148 and 7.150). Around 70% of commutes in Ashford, and 60% in Ebbsfleet are made 10km (between ward centroids) in 2001 (see figs 7.149 and 7.151). Currently 10% of commutes from least deprived wards, and 6% of commutes of most deprived wards in Ashford are in the 50-100km distance band, where destinations include central London (Westminster, the City and Docklands). Central London is within the 25-50km band for Ebbsfleet, which has 17% of commutes from least deprived wards and 13% of commutes from the most deprived wards. These base data provide a framework for understanding the volume of local and regional commutes at the hubs before the full impact of the HS1 domestic service is captured.

Mode Shifts between 1991 and 2001

Regarding mode shift measured between the two censuses, it is regrettable that there was too much disparity between the boundaries of the Enumeration Districts and Output Areas to assess the changes at a higher spatial resolution. In this instance aggregation to ward level allowed a more general comparison between the censuses. The increase in car use over sustainable modes, and which sustainable modes were increasing and decreasing over the last three censuses (1981-2001), is clearly demonstrated at both hubs (figs. 7.171-172 and 7.176-177). Achieving a higher proportion of sustainable mode usage as the primary mode (and secondary with regards to access to the primary mode) over the current pattern of usages falls in with the aims and objectives of Kent's Local Transport Plan (*ibid.*). The MUTP-related transport infrastructure changes including the new BRT lines planned and currently in service at the hubs will hopefully encourage that shift. The fall in sustainable mode use (and rise in car use) between 1991 & 2001 in some wards (see figs. 7.158 and 7.166), the largest increase of 34% in Ashford, and 24% in Ebbsfleet are mostly beyond the urban core. Commutes of >10km form the largest proportion of all daily journeys, therefore better public transport provision is needed for these local trips, such as increased Park & Ride schemes or further BRT routes, which could be promoted along with the MUTP delivery. Walking remains the second most popular mode for commuting in most areas (see figs. 7.154 and 7.162), especially in wards of higher relative deprivation. 'Walkability Studies' by Living Streets [www.livingstreets.org.uk] could assess why there has been a decline and what could be achieved to reverse the downward trend. Does the MUTP and its associated infrastructure (or other linear barriers) cause a decrease in permeability, making walking more inconvenient or disagreeable? Could the MUTP delivery provide a catalyst for pedestrian improvement?

The maps that allow the BRT feeder bus 'buffers' to highlight the 2001 Output Areas with low sustainable mode usage along the route (figs 7.179-181) are a useful tool. They can aid planners to understand where they can target the promotion of the feeder bus service and its network connections as either a feeder to the railway station, or for the 60% of residents who may use it as a main means of transport to local work (provided it is affordable). In both Ashford (fig. 7.179) and Ebbsfleet (fig. 7.181), the feeder routes coincide with high areas of non-car / bus usage, although many of these OAs are lower usage in 2001 than the previous 1991 census. Here the maps indicate clearly where sustainable mode use has both fallen in the last decade hence is relatively lower in 2001, and where it is of a low proportion to car use in absolute terms.

Finally a breakdown of modes by SuperSegment classes (as per the Transport Needs Index (Duckenfield 2009)) reveals that some demographic classes in Ashford are not utilising the various modes as closely as their Transport Needs Index may imply. This typology could offer a supplementary method of monitoring if public transport is meeting the needs of those

who are deemed to require it the most. It can assess the changes in proportion of public transport modes vs. private, or sustainable vs. car usage to clarify the types of demographic who are using the bus or train the most.

As discussed above, bus usage in Ashford is highest in those SuperSegment classes that have the highest needs. As seen in fig. 7.131, 80% of those living the most deprived wards tend to travel under 10km to work, hence train patronage is a less likely option for the commuting mode. However 35% of the relatively deprived Multi-cultural urbanism classed population in Ashford walk to work rather than catch the bus. Is this possibly for geo-spatial reasons (these OAs are too close to a high proportion of employment locations to merit other forms of transport) or for socio-economic reasons?

In Ebbsfleet the Multi-cultural urbanism population also has the highest relative proportion of commutes via walking (15%), and also like Ashford these OAs are located in the urban core. Hence it is possible that their Transport Needs Index is less relevant in such geographical contexts. Yet this SuperSegment group has the highest combined public transport usage, with train use higher than those in Country life, typically rural and relatively less deprived areas. Therefore there are issues to be considered regarding access or other barriers to those in Country life OAs utilising the train for their long-distance commutes and to discourage their very high car dependency.

The stacked bar charts for SuperSegment mode proportions (figs 7.182 and 7.184) will be useful for planners for comparing between time periods for the same class, rather than assessing the variation between the different classes. This is due to the diversity in spatial locations and disparity between proportions of the hub populations within each class. Over time, planners concerned with achieving lower car usage and higher utilisations of affordable sustainable modes for commutes would expect to see higher proportions of bus usage, or walking and cycling where feasible for shorter distances. This would not only be for those with the highest public transport needs, as those modes become more attractive, but increased train and motorbike usage relative to decreases in car use for those less deprived areas with longer commutes.

With regards to achieving the indicator aim, again, it is too early to tell. The temporal and spatial resolution of the dataset does not indicate that the delivery of the MUDP has encouraged commuters out of their cars and on to buses and trains, or walking and cycling. The 2011 census may have a more revealing pattern for Ebbsfleet now that Fastrack has been in operation for a few years, but will not take into account Ashford's SmartLink service, proposed to start in late 2012. Carrying out this assessment in the future at LSOA or OA level will be of more use to planners wishing to introduce further extensions to the BRT or

new MUTP feeder routes with better clarity regarding what modes are being used and who has high public transport needs.

Future guidelines for planners and decision-makers

Being able to explore the dynamics between origin-destination interactions, transport modes, relative public transport needs and deprivation/affordability is a powerful tool. Effective measures can be based upon these outcomes to achieve local transport plan aims and objectives regarding increased sustainable travel patterns in the area. This therefore links the regional and local planning for the MUTP to bring positive changes at the hubs related to less long distance, car-based journeys. The MUTP can serve as a catalyst for regeneration in the area, thereby instigating a step-change in local and regional travel patterns, from which planners can shape long-term positive sustainable mobility. This will in turn provide further data for best practice employed in future collaborations between MUTP decision-makers and local transport planners.

Lessons Learnt for planners & decision-makers

Journey-to-work workplace flows (where) and mode shift (how) patterns can both be considered relatively knowable processes. Therefore, with reference to the *Cynefin* decision-making framework, good practice from other areas may be very effective in reducing the level of car uses for commutes and addressing issues of high levels of long-distance commuting. Scenario-planning by 'experts' in sustainable transport planning is viable, and an organic, consensual management approach is recommended. Some elements of this indicator that could be of use to MUTP-related local transport changes:

1. that intra-ward journeys are not necessarily the most common commuting distance for dense urban areas, but conversely such distances are common in more rural wards.
2. there appears to be a real difference between distances travelled to work between the most and least deprived areas around the station
3. walking is still a very popular primary mode at these hubs
4. buses are not necessarily the most utilised mode by those deemed to have the highest public transport needs (journeys made by cars or walking are instead more common).

This marks the close of chapter seven, the main indicator set inputs and outputs. Within this chapter, demographic diversity, deprivation, accessibility, physical barriers and patterns of transport usage were described for the two hubs. The *Cynefin* framework was employed to suggest lessons learnt and future guidelines for planners and decision-makers, and technical and conceptual critiques were given of the indicators. The following chapter gathers many of these indicators together to provide an aggregate measure of the MUTP's impact, as a combination of the indicators in this chapter plus, supplementary measures of community cohesion and social exclusion.

8. The social impact indicator set: Introduction to the Combined Score and meta themes indicators

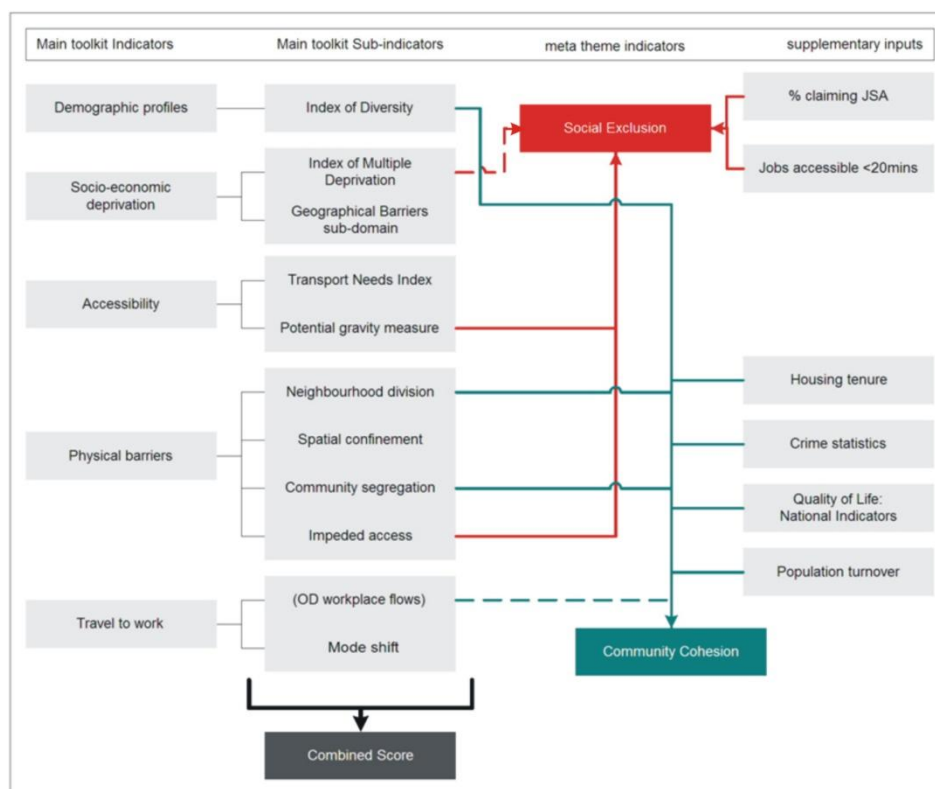


Fig. 8.1: data inputs into the combined and meta theme indicators

The first section of chapter 8 will explore the potential of combining the preceding the previous indicators into a single 'Combined Score' value to consider the overall effect of the MUDP on the wards in Ashford and Ebbsfleet. The second section is concerned with extracting various sub-sets of the indicators with supplementary datasets to consider the changes in community cohesion and social exclusion. These are themes that are not directly associated with the implementation or delivery of an MUDP. Yet the indicators measured in the preceding chapter 7 are presumed to be impacted to various extents by the MUDP that in turn could mitigate or exacerbate low community cohesion or high social exclusion, if it is already a risk in the hub. These latter themes are explored only in the main case study, Ebbsfleet.

This chapter follows the same format as chapter 7; each sub-chapter contains three sub-sections: a) methodology, b) data inputs and map outputs, and c) findings of that indicator.

8.1a

The Combined Score indicator:

Methodology

Exploring the preceding indicators individually in chapter 7 allows decision-makers and planners to consider the many facets of social impacts an MUP could have upon an urban community. However, exploring these indicators together makes an assessment of the issues for the purposes of appraising and evaluating an MUP more holistic. Adding them together with a variety of ranking scores to reflect the risk of adverse or potential benefits of the MUP to the non-user population can provide a way to formulate a strategy for managing the local and regional 'distributive effects' at the hubs. The basic nature of the cumulative scoring reflects the difficulty in quantifying these outputs. Giving a 'level of confidence' or 'margin of error' is unsuitable as one is trying to examine and communicate areas that are at relative potential risk of adverse impacts over neighbouring areas under study. The inherent differences in the spatial configuration and demographic profiles of Ashford and Ebbsfleet provides a comparison for considering how the indicators influence each other and how the social changes that occur at each hub manifest differently, providing the chance to explore the complex nature of capturing social impacts.

Aim of the indicator

This cumulative indicator aims to facilitate the exploration of the summative effect of the potential impacts. This can provide planners and decision-makers with maps and associated charts to assess the hubs in terms of prioritising neighbourhoods with intervention measures so as to reduce social disbenefits, and promote favourable outcomes of the MUP implementation.

Objectives

To create the following sub-indicators for incorporation into the Combined Score Indicator.

In Ashford these are:

- IMD rank change (2004-07)
- IMD Geographical Barrier Sub-Domain rank change (2004-07)
- Index of Demographic Diversity: 2001 OAC group variability (intra-ward)
- Accessibility measure
- Physical Barrier: Neighbourhood Division
- Physical Barrier: Spatial Confinement
- Sustainable mode: percentage change 1991- 2001

Ebbsfleet has all the above sub-indicators, plus a further two:

- Physical Barrier: Community Segregation
- Physical Barrier: Impeded Access to local facilities

As noted in the Physical Barrier chapter (7.4) above, Ashford does not have these two latter sub-indicators as the hub has no directly MUDP-related residential development nor a high resolution dwelling / facilities dataset (utilised in Ebbsfleet for comparative purposes).

Method

This indicator explores the final combined scores and considers the overall potential impact from the preceding generated indicators on the hubs. For the final assessment, wards within the 3km core analysis zones around the CTRL stations are extracted from the wider 10km analysis zone context for a closer look at the hypothetical effects of the MUDP and the strengths or weaknesses of the each of the social impact indicators.

- The Index of Demographic Diversity is transformed to standard deviations (Std. Dev.) of the mean diversity value for the 10km area, and then ranked with a positive, neutral or negative value (for above to below average diversity).
- Indices of Deprivation-related map data, i.e. rank position changes between 2004 and 2007, are aggregated from LSOA level output to ward level, and scored with a positive, neutral or negative value relating to the change of rankings of the ward in 2007.
- The accessibility scores are more complex, whereby the proportion of OAs or dwellings (depending in the resolution of the input dataset) in a ward that benefit from the new feeder bus routes are weighted depending upon their accessibility measure, and ranked relative to all wards along the bus route.
- The Physical Barriers sub-indicators are awarded a basic binary value, zero if the ward has no direct impact and -1 if the ward has a perceived negative impact within its boundaries. The scoring is not more specific as this indicates only that these are potential issues in the area, the extent of which is dependent upon individuals' perceptions.
- The final input is the Journey to Work mode shift between 1991 and 2001, where wards are ranked positive to negative depending on the direction and level of percentage change of sustainable mode usage in the 10 years. Due to a limited sampling strategy, the workplace flow data have been excluded from the combined score, although the assessment of the commuting data is considered in the later Community Cohesion meta theme sub-indicator (chapter8.2).

A simple weighting scheme was utilised to emphasise the extent to which the indicator data is likely to have been impacted by the implementation of the MUDP, tempered by the likelihood that patterns in the data are viable to be MUDP related (due to resolution issues).

The Index of Diversity and IMD rank changes are both unweighted, as changes in demographic mix and deprivation around the hub can be considered as highly complex processes subject to many non-MUTP influences. All the Physical Barriers sub-indicators are weighted by a factor of 2, as despite being direct results of physical MUTP infrastructure changes in the ward, their impacts are nebulous without closer contextual exploration. The Journey to Work mode shift input is also weighted by a factor of 2 as the changes between 1991 and 2001 can only very tentatively be attributable to the MUTP-related transport changes, although this is an important variable which would be weighted by a factor of 3 with higher resolution (spatially and temporally) more recent data. The final indicator input weighted by a factor of 2 is the Geographical Barriers IMD sub-domain. The inclusion of this variable is expected to reflect the changes in both local road infrastructure changes, and increasing or decreasing numbers of local facilities. Both of these could be knock-on effects of the MUTP delivery between 2004 and 2007. Furthermore there is a small risk of double counting with the inclusion of both the main IMD and this sub-domain, although the use of rank place changes as inputs for both, and the fact that the Geographical Barrier sub-domain accounts for less than 5% of the final IMD score but is weighted twice as highly as the IMD rank changes alone, mitigates the effect of potentially double counting to a negligible level.

The only input variables to be weighted by a factor of three in this example is the Accessibility Measure for SmartLink and Fastrack B feeder services, given that these are potentially significant objective changes to some of the wards' population with regards to accessing local facilities and employment locations; assuming it is affordable. A brief assessment of the effect of the weighting on the final output is given.

The individual data from 17 wards in Ashford's 3km zone, and 12 wards in Ebbsfleet's, are quantified according to the method explained above (and in greater detail alongside the maps below in 8.1b), to estimate a cumulative relatively 'favourable', 'neutral' or 'adverse' social impact. It is in a simple and intuitive format, aiding decision-makers to absorb the results quickly, and easily adapt the inputs for further exploration. The maps are followed by a straightforward linear regression (Carstairs score vs. combined weighted impact score) to consider if there is a correlation between the level of relative deprivation and the perceived measured impacts of the MUTP. The Carstairs score is used rather than the IMD score or rank as they tend around a value of zero, with those less deprived than the national average having an increasingly negative score the less relatively deprived they are, and those above the national average an increasingly positive score. This characteristic is useful to produce a scatterplot with quadrants within which the combined impact scores fall, and dividing the wards into priorities for attention for decision-makers (discussed in more detail below). Future work that could be carried out at a higher spatial resolution such as LSOA could transform the IMD scores to mimic this effect if deemed useful.

Finally, radar charts are produced for each ward and displayed as a small matrix created to assess the visual benefits of exploring all the variables simultaneously.

Future guidelines for planners and decision-makers

This combined indicator could aid planners greatly to minimise overall adverse outcomes and learn from the example of areas that experience relative benefits and an overall favourable outcome. A 'decision-makers response matrix' is proposed within which areas of the hub are placed in quadrants that prioritise the potential need to intervene based on context-specific variables. With reference to the complex adaptive systems diagram (fig. 6.3; the Seven Samurai of Systems Engineering in chapter 6), this cumulative indicator aims to provide a basis for guidelines utilising positive and negative feedback regarding the implementation of this MUTP.

Lessons Learnt for planners & decision-makers

The impact of the combination of indicators is totally unique to each context and therefore is a 'complex' process. Planners will be required to 'Probe-Sense-Respond' repeatedly over the long-term in order to be able amplify positive effects or to dampen any negative impacts of the MUTP on the community. However, insight as to where there are areas potentially 'at risk' in the early stages can be beneficial to planners to formulate intervention plans in the short to long term to be integrated within the delivery of the MUTP.

8.1b

The Combined Score indicator: Input data and output maps

The input datasets

The Index of Demographic Diversity input

The original demographic indicator maps (chapter 7.1) were transformed to standard deviations (Std. Dev.) of the 10km analysis zone mean (figs. 8.02 & 8.03 below), whereby the (relatively) most homogenised wards for demographic groups of the OAC were given a low standard deviation (< -2.5 Std. Dev.), and those with average diversity were within ± 0.5 Std. Dev. Those with a high level of diversity, and therefore relatively greatest heterogeneity were in the class > 0.5 Std. Dev. For this measure, the assumption that the greater the diversity, the less community cohesion, leads those wards with 'far below', 'moderately below' or 'slightly below' the mean of diversity in the hub to receive scores of 3, 2 or 1 respectively, average/neutral were assigned a score of zero, and relatively demographically diverse wards were assigned a value of -1.

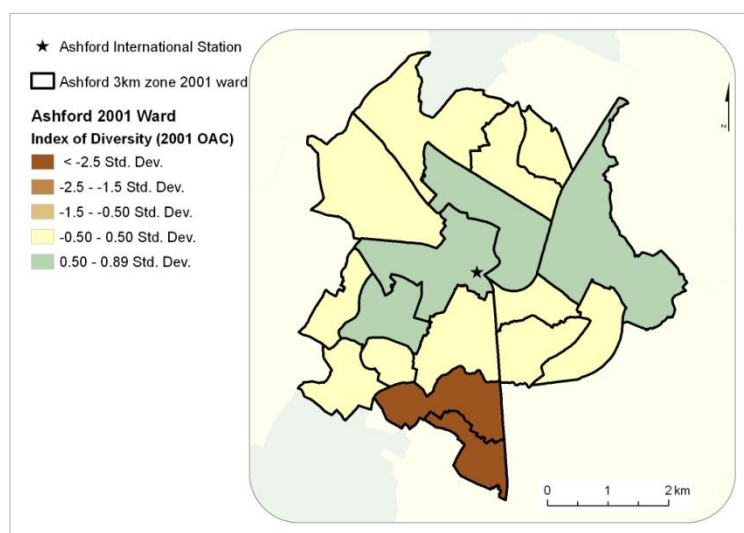


Fig. 8.02: Ashford 3km zone: Index of Diversity input map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

In Ashford, those with the lowest diversity and hence highest score are two peripheral, almost wholly rural/village OAs. In Ebbsfleet (fig. 8.03 below) a ward containing a single OA of Young Families in Terraced Homes results in a very low diversity rating and hence is assigned a value of 3. The Diversity Index is weighted by a factor of 1 in the final Combined

Score (below), as the in/out migration of different demographic groups may (or may not) be influenced by the MUPP at different spatial scales (very localised to regional), but it is not proven here.

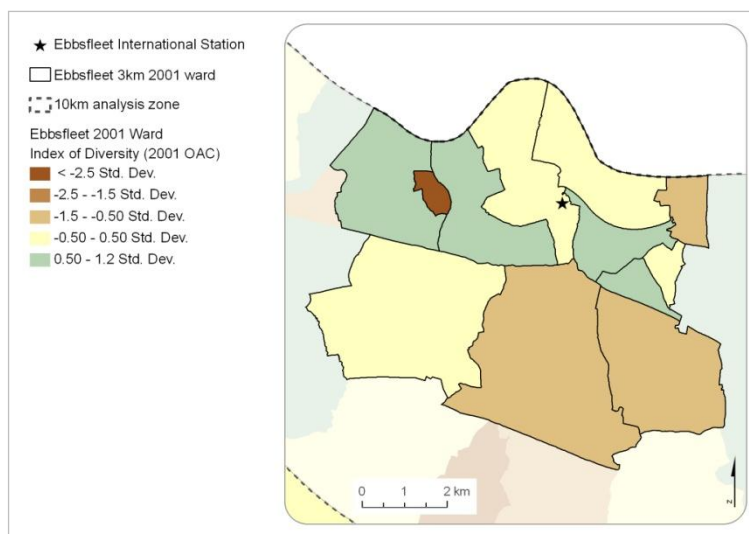


Fig. 8.03: Ebbsfleet 3km zone: Index of Diversity input map [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

Relative Deprivation inputs: IMD and Geographic Barriers: rank changes

The detailed calculations for these deprivation-related measures are found in appendix 10.15. Each Lower Super Output Area is assigned a value in one of 5 classes; -2 (greatest decline; here a rank difference of between -5810 to -2466), -1 (moderate decline; rank difference -2465 to -821), 0 (relatively no change; rank difference -820 to 820), +1 (moderate improvement; rank difference 821 to 2465) and +2 (greatest improvement; 2466 – 4109) (fig. 8.04).

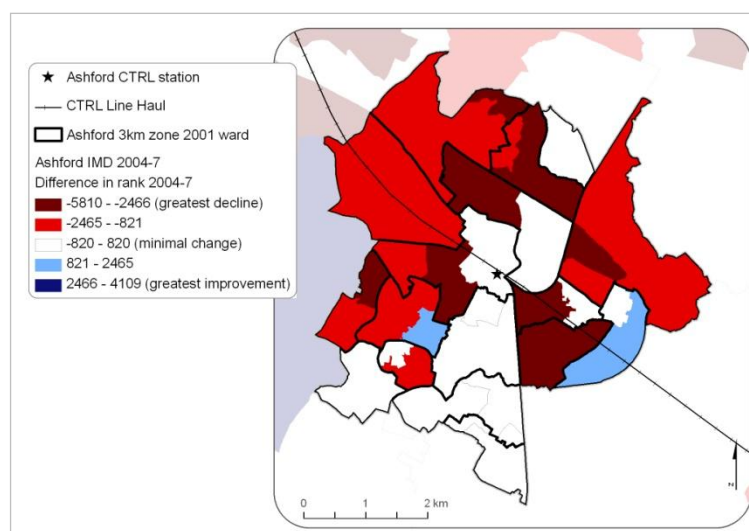


Fig. 8.04: Ashford 3km zone IMD rank changes between 2004 and 2007 input map [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

Hence a ward with four LSOAs, for example two with greatest decline, one neutral and one moderate improvement, would be calculated as follows $[2 \times -2, 1 \times 0, 1 \times 1]$ so the ward has an overall score (i.e. the sum) of -3 for this measure. Issues mentioned in the Case Study (chapter 5) regarding the lack of equality between sizes and population density of wards is brought to light here. One can see how they vary in the number of LSOAs they contain, ranging from a single LSOA to containing a maximum of four. However, this basic technique does offer a fairly representative assessment of the combined rank change for the ward, given the hindrances previously mentioned regarding boundary changes over time. The calculation for the Geographical Barrier deprivation sub-domain is identical to above (fig. 8.05), save for the parameters in rank change values that comprise the classes. The same approach is employed to score the two mapsets for Ebbsfleet's IMD rank change (fig. 8.06) and Geographical Barrier rank change (fig. 8.07), below.

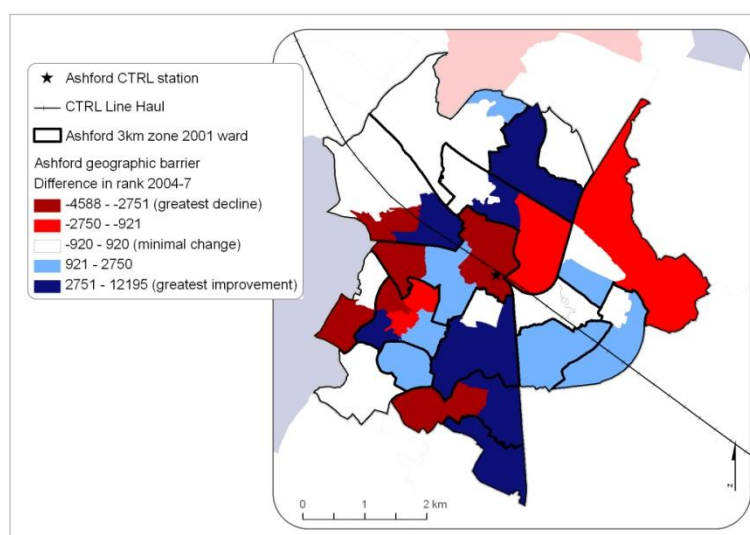


Fig. 8.05. Ashford 3km zone IMD rank changes between 2004 and 2007 input map [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The IMD rank change impact indicator is weighted by a factor of 1 (the lowest – essentially no extra weighting) in the final Combined Impact Score, as deprivation can only be loosely associated with the changes that the MUTP brings to a hub. Moreover, many external policies and local/regional government initiatives and work will be influencing this in ways that may over-ride the potential influence of the MUTP. Nonetheless planners would aspire that deprivation would be decreased and the MUTP could provide a substantial investment in the local area, to aid towards this.

The Geographical Barriers sub-domain indicator is weighted by a factor of 2 (mid-level) as this deprivation element is closely tied to changes of relative accessibility to a range of local facilities. New developments around the station could reduce further straight-line distances to the nearest facility, hence is the opposite perspective of the Physical Barrier 'Impeded Access' sub-indicator.

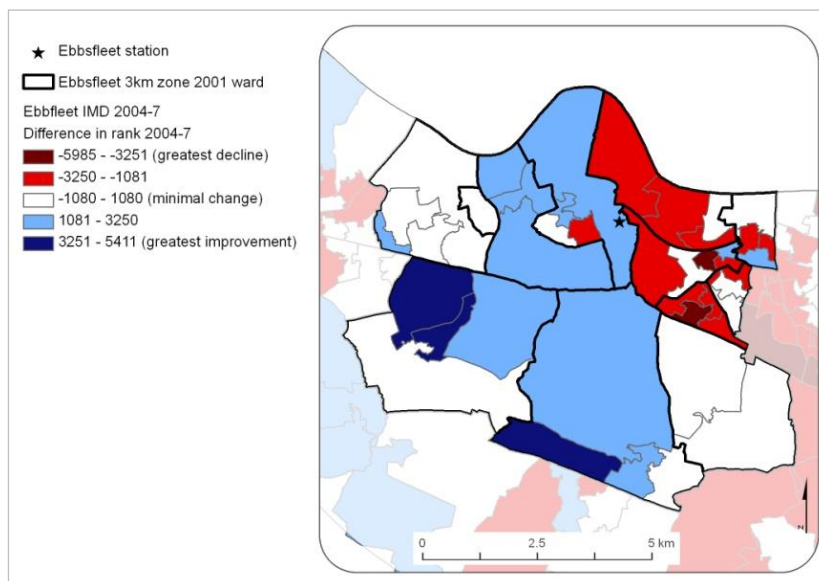


Fig. 8.06: Ebbsfleet 3km zone IMD rank changes between 2004 and 2007 input map [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

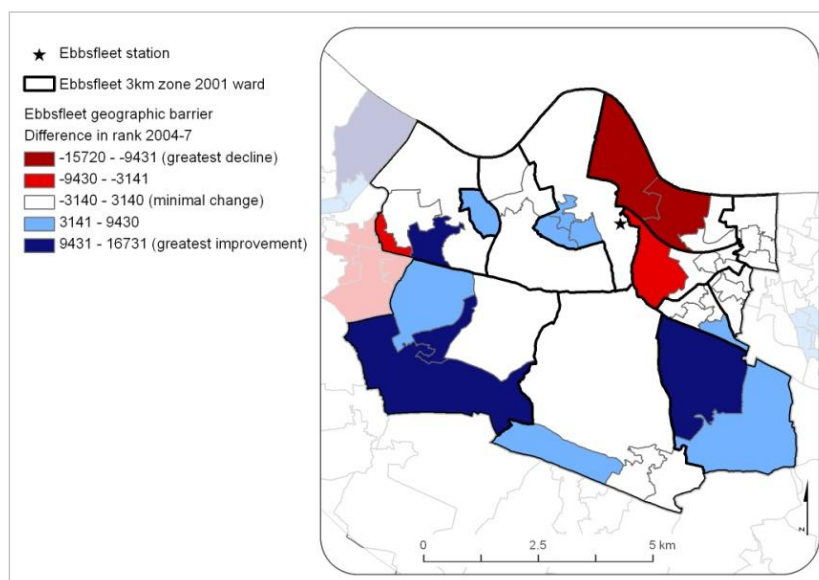


Fig. 8.07 Ebbsfleet 3km zone Geographical Barrier rank changes between 2004 and 2007 input map [DCLG Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

Relative changes in Accessibility measures: Feeder bus services

In Ashford, to order to quantify the Accessibility measure score, the eleven wards that contained an Output Area population weighted centroid that fell within the SmartLink 400m buffer were extracted. These 'SmartLink buffer OAs' were counted as a percentage of all OAs in that ward (see fig. 8.08 below and the detailed calculations in appendix 10.16). Subsequently, the percentages were converted to score 'bands'; a value of 1 for those wards that had between 0-12% of OAs within the SmartLink 400m buffer, 2 for wards with 13-30%, and 3 for >30%, which ensures approximately equal numbers of wards in each score band. Furthermore, those OAs within the buffer were ranked in order of 'high', 'medium' and 'low' transport needs from the Transport Needs Index and assigned a 'needs weighting' value of 3, 2 or 1 respectively. The needs weighting and score band were summed for an initial score value. As several wards had different proportions of high, medium and/or low needs OAs (see fig. 8.08 below), a mean value of all scores for that ward was taken to give a final score

ranging from 2 to 6. This resulted in situations where a ward with a low proportion of high need OAs, and a ward with high proportion of low needs OAs were given a similar final score.

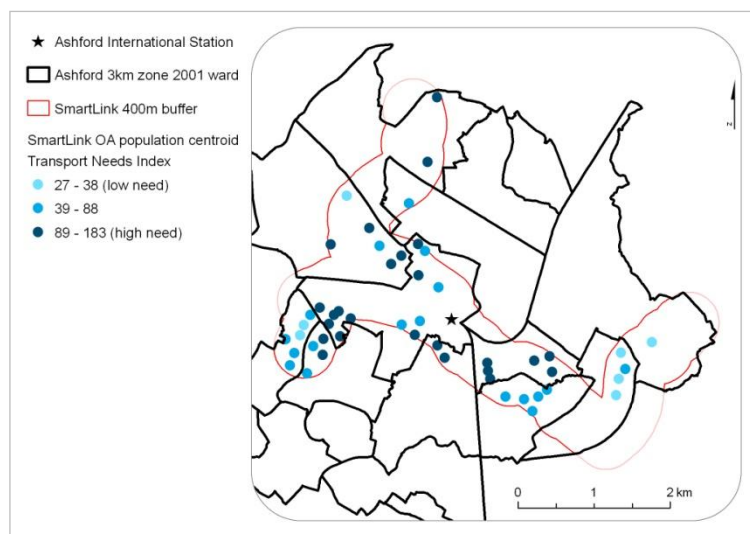


Fig. 8.08: Ashford 3km zone wards with Transport Needs Index OA centroids in the SmartLink buffer [Duckenfield 2009, 2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

For Ebbsfleet, a slightly different approach was taken as the accessibility index from Fastrack B feeder service was at dwelling level (fig. 8.09 below). For this impact indicator score, the number of dwellings within a Fastrack 400m bus stop buffer was calculated as a proportion of all dwellings in that ward, and once more the percentages were transformed to a score band. This time, there were a very high number of proportions under 8% (<1 Std. Dev.), which were all assigned a score band value of 1. The remainder are ascribed to band 3 and 4 reflecting their higher proportion (24% (>2 Std. Dev.) and 32% of all ward dwellings were in a Fastrack bus-stop buffer (>3 Std. Dev.)).

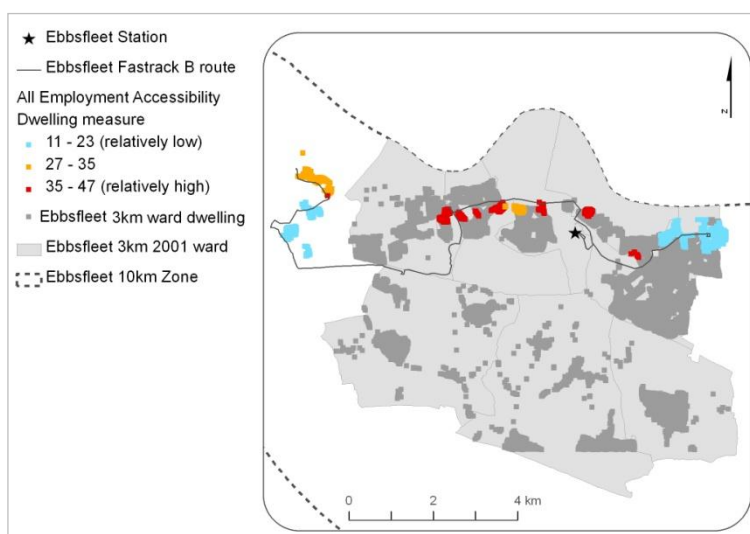


Fig. 8.09: Ebbsfleet 3km zone ward with all employment accessibility dwellings vs. all dwellings [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The range of measured accessibility values for the dwellings were divided equally into three classes; relatively high changes in accessibility to all facilities/employment locations were assigned a value of 3, a moderate change in relative accessibility a 2, and a relatively low change in accessibility assigned a value of 1. These latter values are weights added to the score band. Three of the five wards have dwellings with a mixture of different accessibility measures, hence a mean of the score band plus weighting is taken to give a final ward score between 3 and 6 (detailed calculations are in appendix 10.16). The accessibility measure impact is weighted by a factor of 3 (the highest) in the Combined Score as its influence reflects the most tangible MUDP-related change for non-MUDP users.

Physical Barriers: Neighbourhood Division

For all the impact sub-indicators in the Physical Barriers indicator input, a binary score system has been employed whereby if a ward appears to be affected (i.e. an impact is located within the ward boundaries) by the CTRL line haul, it is assigned a value of -1, otherwise a value of zero is given. In Ashford (figs. 8.10 and 8.11) three wards are potentially impacted by the line haul dividing areas that are assigned the same Output Area Classification demographic group (a proxy for 'neighbourhoods').

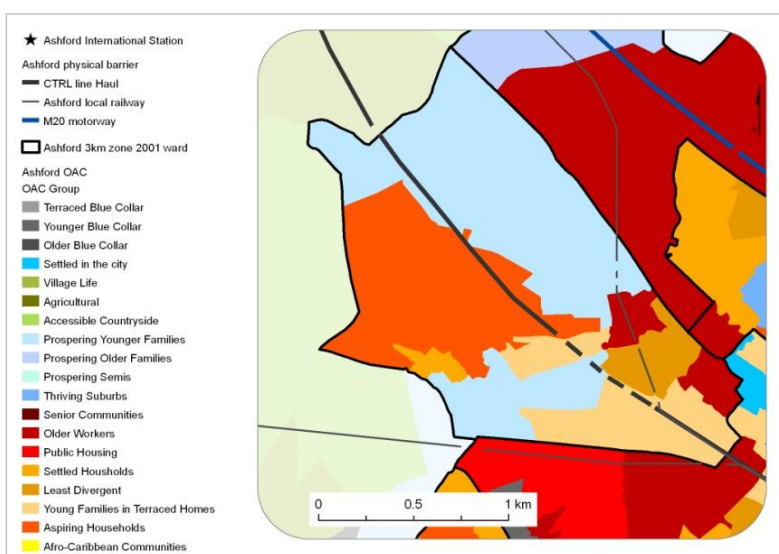


Fig. 8.10: Neighbourhood Division northern Ashford 2001 ward and 2001 OAC with linear barrier (CTRL) and passes [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

The first has Prospering Younger Families, Aspiring Households and Young Families in Terraced Homes, although the latter has several local bridges or underpasses. The second and third wards (fig. 8.11 below) suggest a division of Prospering Older Families and Settled Households with only one line-haul pass in that area. Caveats mentioned in a previous chapter (7.4a) suggest that local knowledge of this context would reveal the configuration of the local neighbourhoods around the line-haul and the extent to which the alignment of the CTRL divides a 'real community'. This tool is most useful in the preliminary planning of an MUDP.

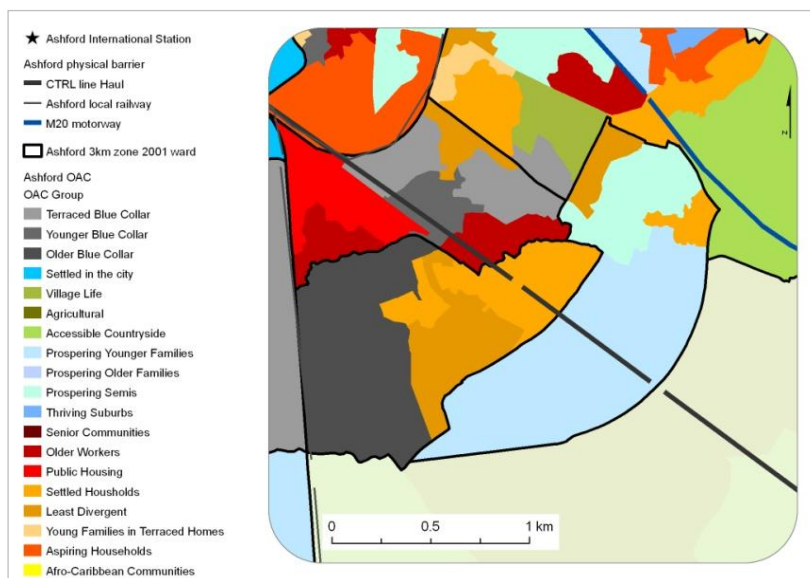


Fig. 8.11: Neighbourhood Division southern Ashford 2001 ward and 2001 OAC with linear barrier (CTRL) and passes [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

In Ebbsfleet (fig. 8.12 below), the CTRL divides a single ward with an OAC group classification of Young Families in Terraced Homes, but with the supplementary data available; dwelling locations from MasterMap Address Layer 2, one can see that the residences are separated quite significantly both by distance and the pre-existing North Kent railway line haul. As this is an example of if exploring the issue from coarse level data (as per Ashford) could fail to capture the nuances of the spatial configuration of the dwellings, Ebbsfleet has no negative values for Neighbourhood Division impact indicator. In general, this indicator is weighted by a factor of 2 in the Combined Score, as although the CTRL line haul is clearly a real barrier and a first order impact of the MUP, the sense that one's neighbourhood is 'divided' is rather abstract and subjective.

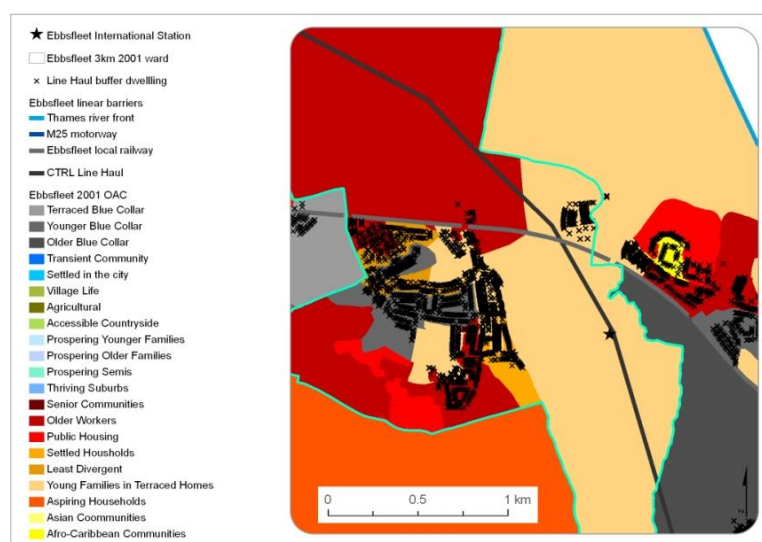


Fig. 8.12: Neighbourhood Division: Ebbsfleet 2001 ward and OAC [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003] with linear barriers (CTRL & North Kent) and passes

Physical Barriers: Spatial Confinement

Once more there is a binary score for the wards in this indicator. If the ward is impacted by the relative spatial confinement between a linear barrier (other railway lines, a motorway or the Thames) and the new CTRL line haul, it is assigned a value of -1 , otherwise a value of zero. In Ashford (fig. 8.13 below), six wards have areas that are relatively more confined relative to the pre-MUTP urban configuration, to varying extents.

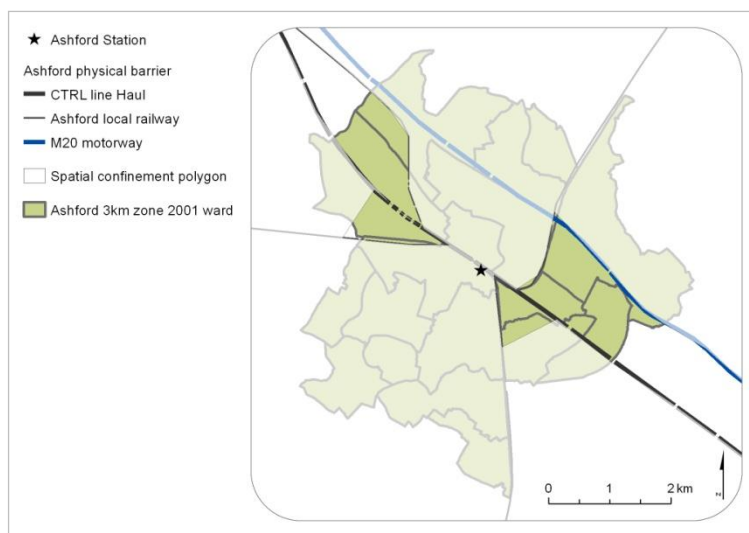


Fig. 8.13: Ashford spatial confinement polygon aperture over 2001 wards [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

In Ebbsfleet (fig. 8.14 below), three wards can be considered more spatially confined following the delivery of the MUTP. The Physical Barrier indicator section (7.4), which originally explored this impact, demonstrated that with the supplementary MasterMap dwelling dataset that the confined polygons have hardly anyone resident within them. However, the MUTP-related development, Ebbsfleet Valley, is planned to occupy this space therefore these potentially impacted wards are assigned values of -1 .

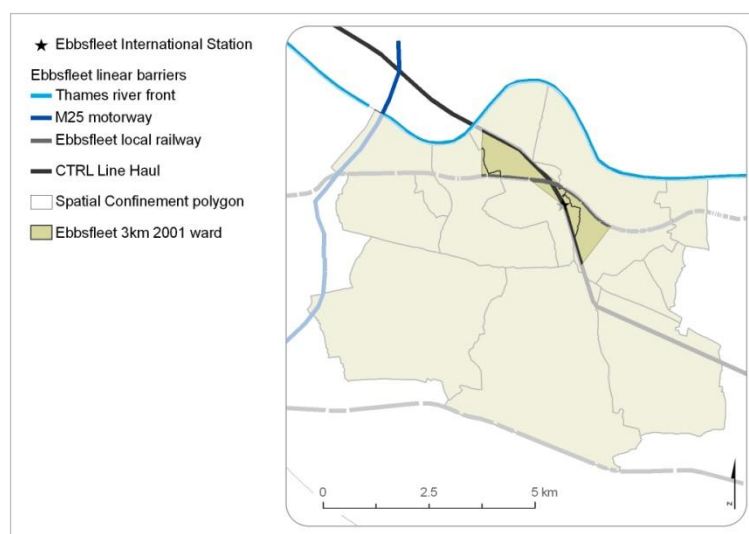


Fig. 8.14: Ebbsfleet spatial confinement polygons over 2001 wards [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

This indicator is weighted by a factor of 2 in the Combined Score for the reasons defined above for all Physical Barrier sub-indicators.

Physical Barriers: Community Segregation

Ebbsfleet has two supplementary Physical Barriers impact indicators over Ashford; the first is the Community Segregation. This explored the extent to which the MUP-related housing development inter-faces with an existing community, particularly where the new and old communities are of sufficiently different demographic groups that interaction could potentially cause social conflict and/or tension.

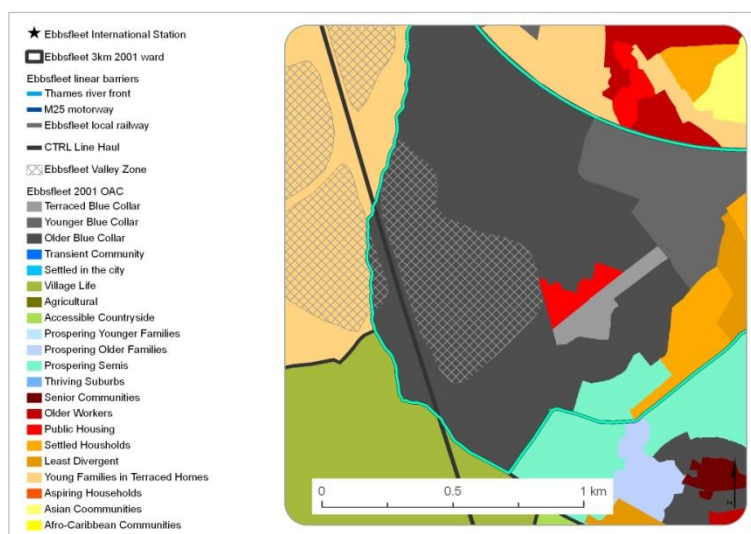


Fig. 8.15: Community Segregation: Ebbsfleet 2001 ward, 2001 OAC and Ebbsfleet Valley development. [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

In Ebbsfleet, Springhead Park, a new housing development part of the Ebbsfleet Valley Masterplan, adjoins a neighbourhood of Older Blue Collar Workers and Public Housing (OAC Groups fig. 8.15). In research mentioned previously in chapter 2.2, in situations such as these, a 'minor' barrier can reduce the need for any potentially unwanted spatially interaction between communities, hence the CTRL line haul could fulfil this task. However neither the railway line or any other infrastructure or natural topography as per the rest of the old/new community interface, provides community segregation. Hence in this indicator one ward detailed in the map above is assigned a value of -1 , as a location of potential community tension to be considered by planners in the early stages of the MUP-related urban regeneration of the brownfield site. This indicator is weighted by a factor of 2, again as this effect is directly related to the MUP associated development yet highly subjective.

Physical Barrier: Impeded Local Access indicator

Ebbsfleet has several wards comprising dwellings and local facilities where the shortest (straight-line) distance traverses the line haul (fig. 8.16). In these cases, a concentration in an area that has many of these shortest-paths crossing the railway line haul could suggest a location for supplementary crossing, particularly for cyclists and pedestrians to mitigate severance issues. In this second Ebbsfleet-only indicator, a ward that has an origin and/or destination point for these shortest paths that cross the line haul were allocated a -1 value, to flag the issue to decision makers. The remainder of the wards have a value of zero.

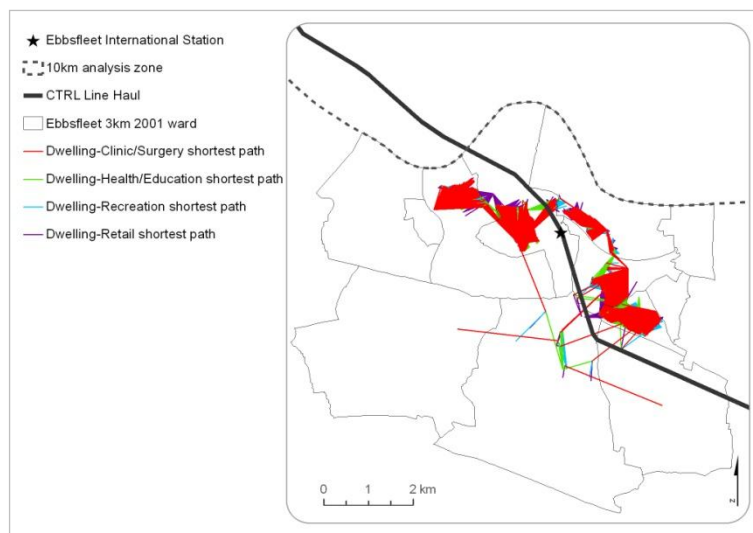


Fig. 8.16: Ebbsfleet Impeded Local Access indicator [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

As the facility classes are so broad, this is a very basic illustrative example of how this may be approached, and no doubt if exploring every facility type individually, the example may yield a more striking pattern. However, no exploration has been carried out to assess to what extent the road network has been altered due to the construction of the CTRL line haul thereby providing a measure of the level of access that was viable before MUTP implementation. This indicator is weighted by a factor of 2 in the current example, but could be considered a 3 for a high resolution before and after impact assessment in a future application of the method.

Sustainable mode: Journey to work, changes over time

Extracting the percentage differences between 1991 and 2001 census responses (at a 10% sample rate for 1991), the 10km zone maps were transformed to quintiles, with the wards with the largest percentage decline in sustainable mode usage (depicted in a dark red) assigned a value -3 (in figs. 8.17 and 8.18), although no ward in the Ebbsfleet 3km zone is in this classification, only in the 10km zone. Those wards of moderate decline (in mid-red) were assigned a value of -2 , and wards with a relatively minor decline (dusky pink) a value of -1 . Wards depicted in light blue, which implies relatively little change, a value of zero, and (in

darker blue), a positive percentage change where relatively more people were journeying to work using sustainable modes, are given a value of 1.

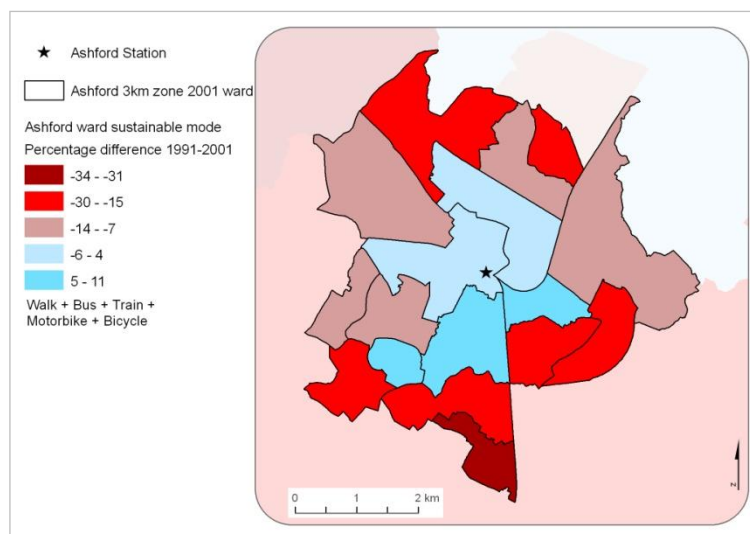


Fig. 8.17: Ashford 2001 wards and percentage of sustainable mode usage difference 1991-2001 [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

This final indicator is currently weighted by a factor of 2 for the combined score in this example, as the timescales for the percentage change precede the MUDP delivery (HS1 domestic service) and the issues regarding transforming 1991 EDs to 2001 ward definitions allows for too much data unreliability in terms of exploring the MUDP impact. Reassessment in a future application of the method extracting the percentage changes between 2001 and 2011 OAs, this indicator ought to carry a weighting of 3 as the MUDP-associated transport changes promote public transport options and less car use at the hubs.

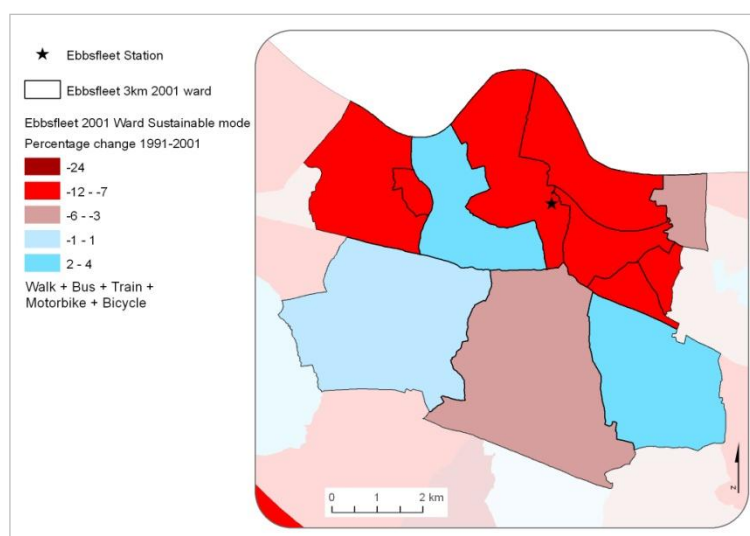


Fig. 8.18: Ebbsfleet 2001 wards and percentage of sustainable mode usage difference 1991-2001 [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

Output: The Combined Score, a cumulative assessment

Once the final (weighted) scores have been calculated for Ashford and Ebbsfleet's 3km analysis zones, they are mapped in order to consider the geographical dispersal of the relative impact scores before considering the strength and weaknesses of the methodology. The graphs for the calculations are provided as well as scatterplots and radial charts to explore the relationships and differences between the wards.

Ashford: Combined Weighted Impact Scores

ASHFORD 3km analysis zone	Ward Name	Ward Code	Carstairs	DEPRIVATION		DEMOGRAPHIC PROFILES	ACCESSIBILITY	PHYSICAL BARRIER		JOURNEY TO WORK	Weighted IMPACT SCORE
				IMD rank change	IMD GB rank change			Neighbourhood division	Spatial Confinement		
	Stanhope Ward	29UBJA	7.36	-1	4	0	0	0	0	2	5
	Aylesford Green Ward	29UBGZ	3.80	-2	0	0	18	0	-2	2	16
	Beaver Ward	29UBHA	2.46	-2	0	0	10.5	0	0	-2	6.5
	Victoria Ward	29UBJE	1.70	-3	-6	-1	15	0	0	0	5
	Norman Ward	29UBHQ	1.52	0	4	0	15	0	0	2	21
	Bookhanger Ward	29UBHC	0.70	-3	2	0	15	0	-2	-4	8
	Bybrook Ward	29UBHE	0.43	-3	8	0	0	0	0	-2	3
	Stour Ward	29UBIB	0.35	-4	2	-1	9	0	0	0	6
	Washford Ward	29UBJF	-0.70	0	0	0	0	0	0	-4	-4
	South Willesborough Ward	29UBHZ	-1.03	-2	2	0	15	-2	-2	-4	7
	North Willesborough Ward	29UBHR	-1.55	-4	0	-1	6	0	-2	-2	-3
	Godinton Ward	29UBHU	-1.86	-3	0	0	9.9	-2	-2	-2	0.9
	Singleton South Ward	29UBHY	-2.29	-3	-4	0	12	0	0	-2	3
	Little Burton Farm Ward	29UBHP	-2.44	0	0	0	0	0	0	-2	-2
	Highfield Ward	29UBHL	-3.61	1	2	0	12	-2	-2	-4	7
	Park Farm North Ward	29UBHS	-4.50	0	0	3	0	0	0	-4	-1
	Park Farm South Ward	29UBHT	-5.20	0	4	3	0	0	0	-6	1

Fig. 8.19: Ashford Combined Score values per indicator input

Considering all the impact indicators together results in an output whereby a high proportion of wards in the Ashford 3km analysis have positive or neutral impacts (fig. 8.19). Scores are on a spectrum of positive to negative, relating to relatively positive to negative impacts. The most relatively positive impact (dark blue), are located in the most central wards south of the CTRL station (fig. 8.20).

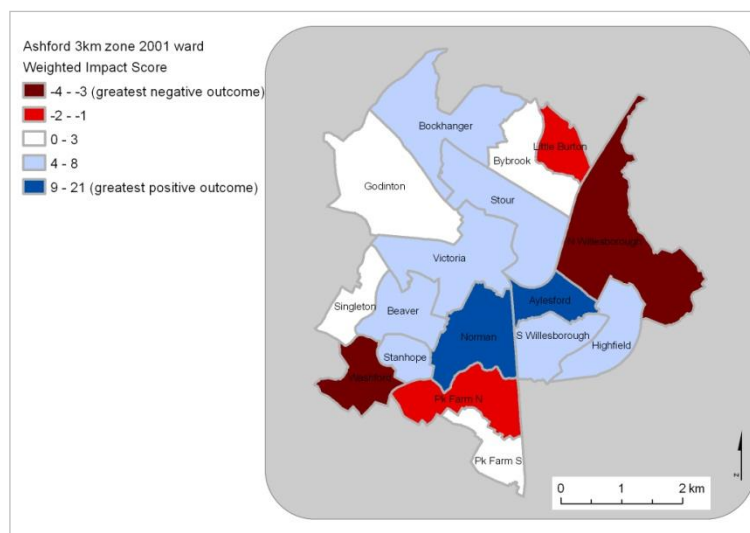


Fig. 8.20: Ashford weighted Combined Impact Score

[©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Seven wards have modest positive impacts and four wards on the periphery are neutral. A further four have moderate to high relatively negative impacts compared to the rest of the zone. The highest combined score is allocated to Norman Ward; with a positive increase in Geographical Barriers ranking between 2004 and 2007, positive proportional sustainable modal shift between 1991 and 2001 and a high Accessibility score from 22% of the high transport need OAs within the SmartLink 400m buffer. The second highest score is for Aylesford Green ward, which is despite a fall in multiple deprivation ranking between '04 and '07 and being located partially within an area of increased spatial confinement due to the line haul (so scores negatively on those measures). These are offset by having 33% of its high transport need OAs within the SmartLink buffer. The ward with the lowest combined score of -4, (Washford) does so due to scoring zero (neutral) on all the variables, except a large negative proportional sustainable modal shift between 1991 and 2001. It is pertinent to recall that the sustainable mode shift indicator serves to highlight areas where car use is increasing, to potentially target future transport plans including extending feeder services, hence not as yet an 'impact' of the MUDP. This absence of actual impacts in the latter ward leading to a negative score is a strong reason to re-qualify these scores as 'not positively impacted' or 'overall negative outcome' rather than actually negatively impacted. The second 'most negative / least positive' outcome in a ward is North Willesborough. Although it has 6% of low transport need OAs within the SmartLink 400m buffer, it scores negatively on IMD rank change (becoming lower on the deprivation rankings) and high demographic diversity

(possibly an influx of new more affluent population drawn to the proximity of the CTRL station?). It is also partially within an area that can be considered relatively more spatially confined due to the line haul, and has a negative sustainable mode shift between '91 and '01.

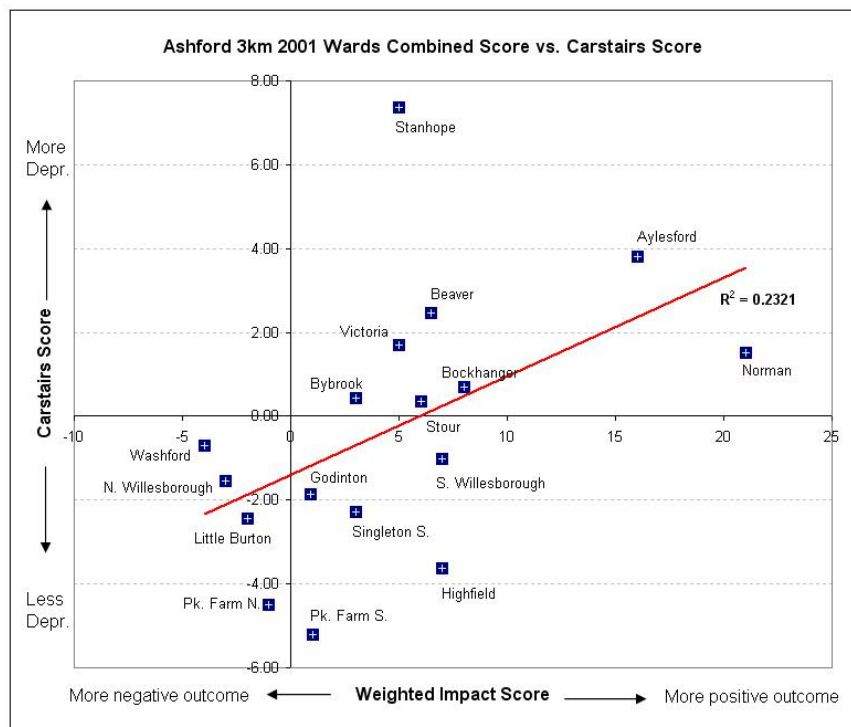


Fig. 8.21: Scatterplot: regressing weighted impact score against 2001 Carstairs Scores for Ashford

To ascertain if there is a correlation between deprivation and the weighted combined score, the Ashford wards are plotted on a scatter-graph and a trendline fitted (fig. 8.21) with a coefficient of determination (R^2). Here we see that the R^2 value is low, which suggests that the deprivation score only accounts for around 20% of the pattern in the weighted impact score, and hence a weak predictor of the overall impact outcome of the MUTP through these indicators based on the Carstairs score alone.

Reproducing the scatterplot for the other individual variables yields one higher R^2 values, the Accessibility measure for SmartLink at $R^2=0.504$ (see appendix 10.17 for the individual scatterplot graphs). Other correlation values are: IMD rank change: $R^2=0.0016$, Geographical Barrier rank change: $R^2=0.035$, Diversity Index: $R^2=0.035$, Neighbourhood Division: $R^2=0.0005$, Spatial Confinement: $R^2=0.024$, and Mode Shift: $R^2=0.33$). As the accessibility indicator has the highest weighting (multiplied by a factor of 3), it is perhaps not unexpected, although a comparison with Ebbsfleet (below) is insightful.

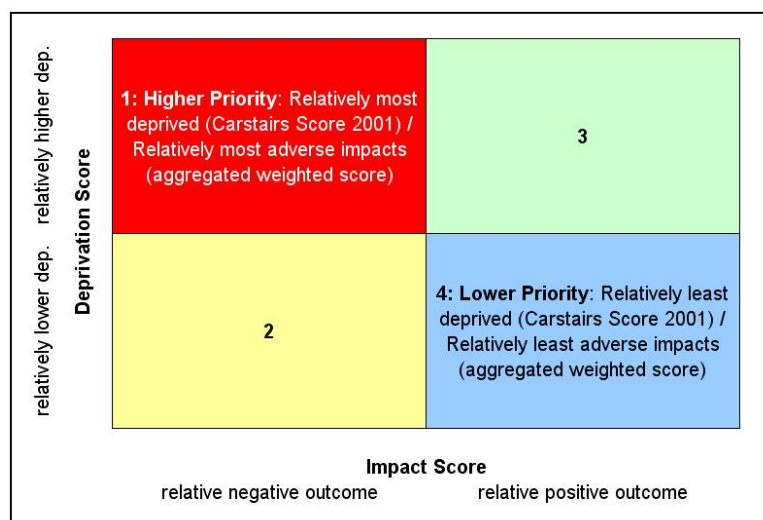


Fig. 8.22: Decision-makers 'response' matrix

The scatterplot above (fig. 8.21) does however suggest that one can clarify which wards would benefit the most from positive planning intervention regarding the MUTP delivery and its second-order 'knock-on' effects.

Wards that are located in the upper left quadrant of the scatterplot are the relatively most deprived in the sample, and have least positive and/or most negative outcomes following the MUTP delivery. These can be considered as relatively high priority needs for intervention by planners and decision-makers in this response matrix (fig. 8.22). Lower left are negative outcomes but wards are less deprived than average on the Carstairs score, hence have second priority for MUTP planning intervention. Third priority are the wards in the upper right-hand quadrant, which although have relatively higher than national average deprivation, they generally benefit (or do not suffer the negative outcomes) from the MUTP. The lower right-hand quadrant wards can be considered relatively low priority, benefiting overall from the MUTP and being relatively least deprived.

In Ashford, referring once more to the scatterplot in fig. 8.21 above, there are no wards located in the upper left-hand quadrant, but four in the lower left hand (23.5% in priority level 2), eight in the upper right quadrant (47% in priority level 3) and five (29.5%) in the lowest level priority quadrant.

Another potential approach to explore the effects of the indicators on the final weighted score is to present the units of observation as radar charts juxtapositioned alongside one another. The shapes vary with the positive or negative values, although the scale axes are ward-dependent, which slightly reduces the effectiveness of cross comparison in this example.

In fig. 8.23 below, are the multiple radar charts of the 17 Ashford wards explored in the Combined Weighted Impact Scores. They are ordered from most negative / least positive

outcome (top left) to most positive / least negative outcome (bottom right), with a solid black line border illustrating the three most deprived (Carstairs score 2001) and a hashed border; the three least deprived. Individual radar charts are reproduced in appendix 10.18.

The first two profiles are very different, reflecting the differing situations described above for the most and second most negatively / least positively impacted wards. The first, third, fourth and sixth profiles are very similar, with moderate differences in Diversity Index in fourth and sixth, and Geographical Barrier index ranking in the sixth alone. The lower part of the matrix (those wards which had the least negative / most benefits) share similar profile traits, negative changes in IMD ranking and sustainable mode shifts and positive result for SmartLink accessibility, and neutral all other variables. [Note that the Norman ward output contains a dummy variable value of -2 for the diversity index solely for this graphical output, as without it, the values could not display].

The distribution of the relatively least and most deprived wards (evident by the distinguishing black (most deprived) or hashed (least deprived) borders) in the matrix further confirms the low R^2 value of minor relationship.

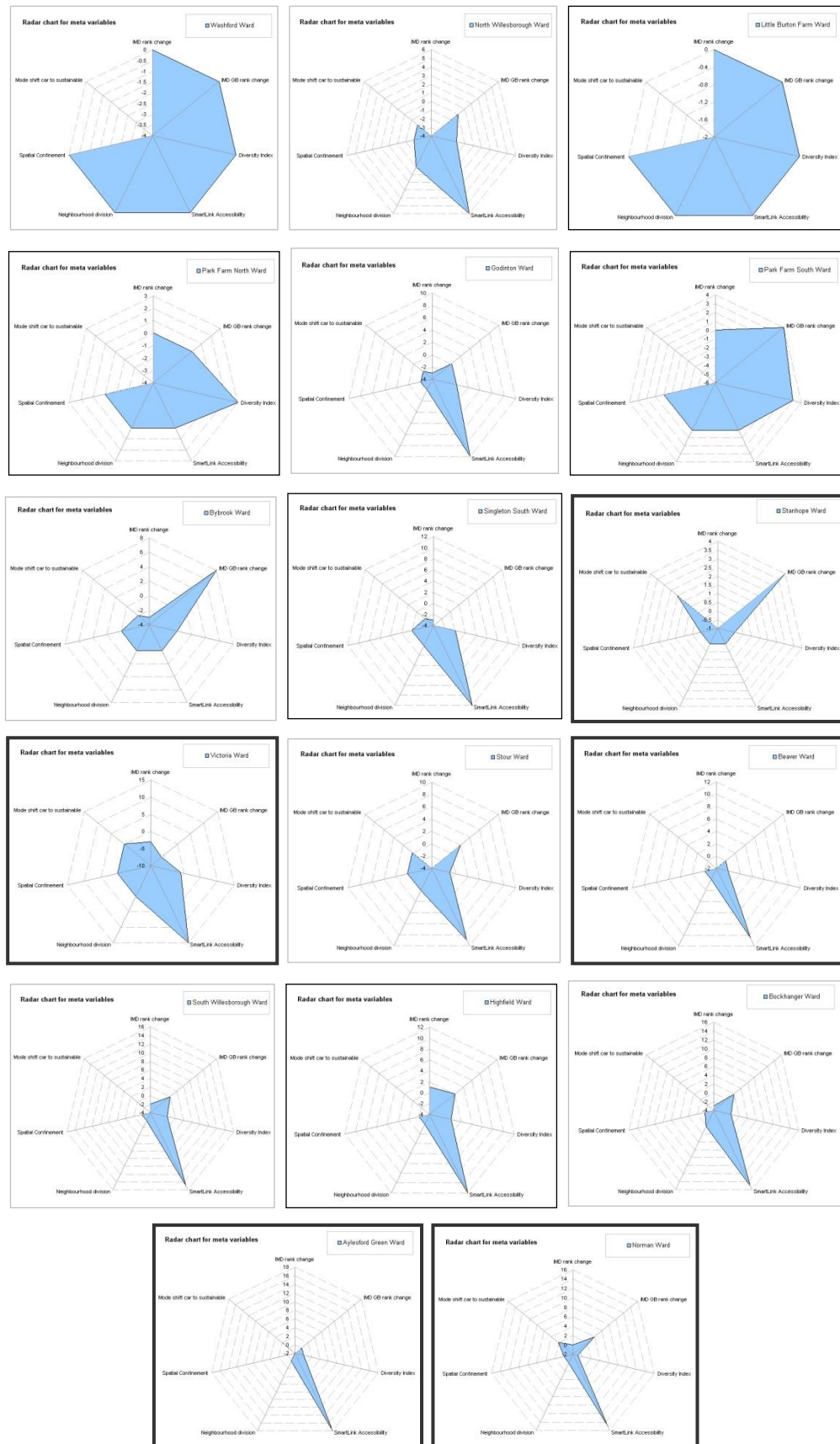


Fig. 8.23: Ashford radar charts

Ebbsfleet: Combined Weighted Impact Scores

EBBSFLEET 3km analysis zone	Yard Name	Yard Code	DEPRIVATION		DEMOGRAPHIC PROFILES	ACCESSIBILITY	PHYSICAL BARRIER				JOURNEY TO WORK	Weighted IMPACT SCORE
			IMD rank change	IMD GB rank change			Neighbourhood division	Community segregation	Spatial Confinement	Impede local accessibility		
	Northfleet North Ward	29UGGD	-3	-8	0	9	0	0	-2	0	-4	-8
	Pelham Ward	29UGGG	-1	0	1	15	0	0	0	0	-2	13
	Coldharbour Ward	29UGFY	-5	2	0	0	0	0	0	0	-4	-7
	Swanscombe Ward	29UDGP	1	6	0	10.5	0	0	-2	-2	-4	7.5
	Northfleet South Ward	29UGBE	-3	-2	-1	0	0	-2	-2	-2	-4	-16
	Stone Ward	29UDGM	0	4	-1	0	0	0	0	0	-4	-1
	Bean and Darenth Ward	29UDGA	5	10	0	0	0	0	0	0	0	15
	Painters Ash Ward	29UGGF	-1	0	-1	0	0	0	0	-2	-4	-8
	Greenhithe Ward	29UDGD	3	6	-1	10.5	0	0	0	0	2	20.5
	Castle Ward	29UDGC	0	2	3	18	0	0	0	0	-4	19
	Istead Rise Ward	29UGGA	0	6	1	0	0	0	0	-2	2	7
	Longfield, New Barn and Southfleet Ward	29UDGU	4	2	1	0	0	0	0	-2	-2	3

Fig.8.24: Ebbsfleet Combined Score values per indicator input

There is an interesting variation in the outcomes for the main case-study hub, Ebbsfleet. The wards that have benefited the least / had the most adverse outcome are located close together in western Gravesend, with a lowest negative score of -16 , lower than the most negative value in Ashford (fig.8.25). There are however, two extra variables for this hub, and therefore they are not directly comparable.

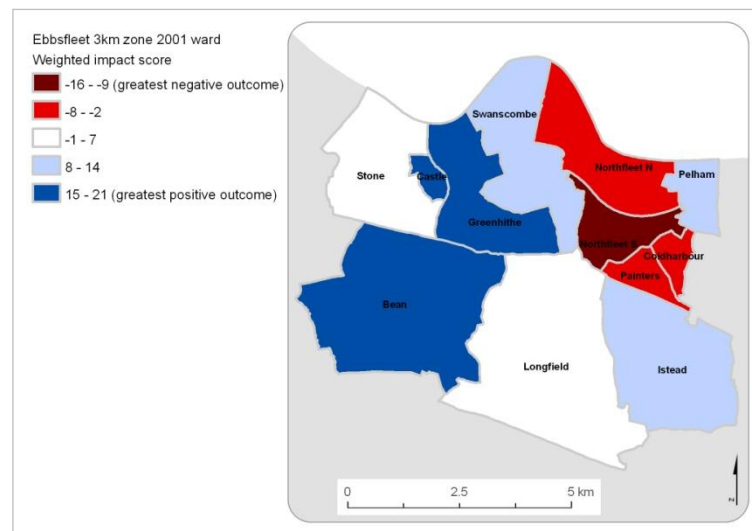


Fig. 8.25: Ebbsfleet weighted combined impact score
[©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

These low negative scores are surrounded by moderately positive value wards whilst the highest favourable impacts / least negative scoring wards are peripheral to Dartford and surrounded by the neutral value wards. Greenhithe ward has the highest positive combined impact score, with a positive IMD and Geographical Barrier rank improvement, positive modal shift away from car use and 8% of the dwellings are in a Fastrack B bus stop 400m buffer. The only negative value for Greenhithe is a -1 score for Demographic Diversity, with all other variables a neutral zero. Castle ward has the second highest positive value, with a positive score for the Geographical Barrier sub-domain, a high Diversity Index score (a single demographic recorded for the entire ward) and a very high Accessibility measure; 24% of its dwellings are within the Fastrack buffers. It does, however have a -4 value for sustainable modal shift between 1991 and 2001 and moreover, it contains the lowest population (five OAs compared to the next lowest of 11 OAs in Istead Rise ward). Therefore it unfairly scores more highly than a larger ward in the Index of Diversity and accessibility measure. Repeating the method at the more evenly populated LSOA-level for future datasets would remove this unfair advantage spatially small wards have over larger.

Northfleet South has the lowest outcome rating; scoring negatively for IMD and Geographical Barrier rank differences between '04 and '07, Index of Diversity (a higher than average mixed demographic), and the new housing development adjoins the pre-existing blue collar community opening the potential for inter-community tension. It also falls into a relative

spatial confinement area, access to local facilities are relatively impeded and also scores negatively for increased car use over sustainable modes. The ward scores zero for all other variables including relative improvement to accessibility, with no dwellings in a Fastrack B bus stop buffer. Northfleet North has the second lowest outcome rating; with negative scores for IMD and Geographical Barrier rankings (the latter a very low value), spatial confinement and sustainable modal shift, but does score well for Fastrack accessibility and neutral on all others.

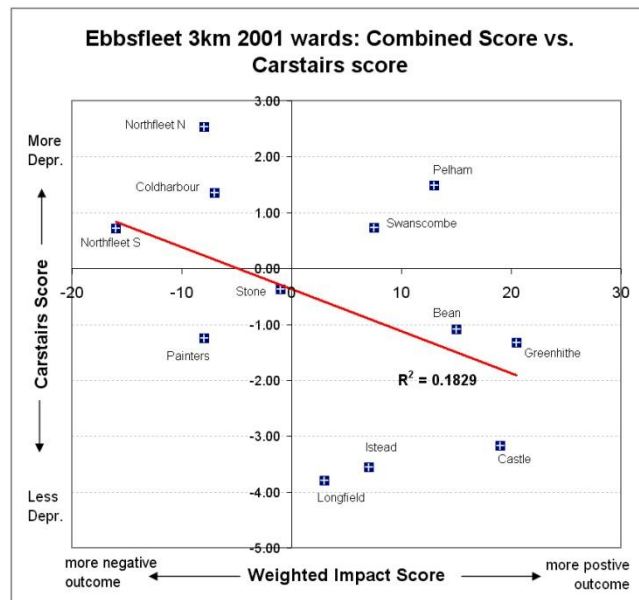


Fig. 8.26: Scattergraph: regressing weighted impact score against 2001 Carstairs Scores

With reference to the 'decision matrix' above (fig. 8.22), the scattergraph (fig. 8.26) above for Ebbsfleet shows that there are three wards (25%) in high priority level 1 quadrant, two wards (c16.5%) in priority level 2, another two (c16.5%) in priority level 3, and five (c42%) in the low priority level 4 quadrant. However the R^2 value is even closer to zero, with Carstairs deprivation score only accounting for around 18% of the relationship. Nonetheless, some of the most deprived wards are in the quadrant with the most negative / least positive impacts, which may indicate to decision-makers that any positive social impacts of the MUTP are not proliferating adequately to the non-MUTP users living in these wards, and to dampen any continuing negative impacts.

The scattergraph plots for other individual impact indicator reveal the following R^2 values: IMD rank change: $R^2=0.42$, Geographical Barrier rank change: $R^2=0.41$, Index of Diversity: $R^2=0.23$, Fastrack accessibility: $R^2=0.32$ despite the high weighting factor, there are no values in the Neighbourhood Division indicator for Ebbsfleet, Community Segregation: $R^2=0.13$, Spatial Confinement: $R^2=0.13$, Impeded Access: $R^2=0.12$, sustainable mode shift: $R^2=0.34$ (see appendix 10.19 for the charts). In contrast to Ashford, these R^2 values are often around ten times higher, but still account for a small percentage of the pattern, even

accessibility which had an R^2 value of 0.5 in Ashford, with the use of a different, lower spatial resolution, accessibility measuring approach.

The Ebbsfleet radar chart icon plots (fig. 8.27 below) do share some interesting profile characteristics with Ashford from first glance; those that have the most negative / least positive impacts (in the top row) are quite 'bulky' with a large area, compared to other end of the impact score spectrum that have shard-like properties. This reflects the difference between scoring mostly neutral values with one (or two) exceptions of either a low negative, or a high positive indicator score. Those with a 'mixture of values' shape have scores that cancel each other out, locating them in the middle of the matrix, which may hide some very low-scoring negative impacts that need to be monitored by planners. Once again, the mix of thick, thin or hashed borders clearly illustrates the relatively low correlation Carstairs deprivation scores have to the impact indicator scores. See appendix 10.20 for larger scale radar graphs.

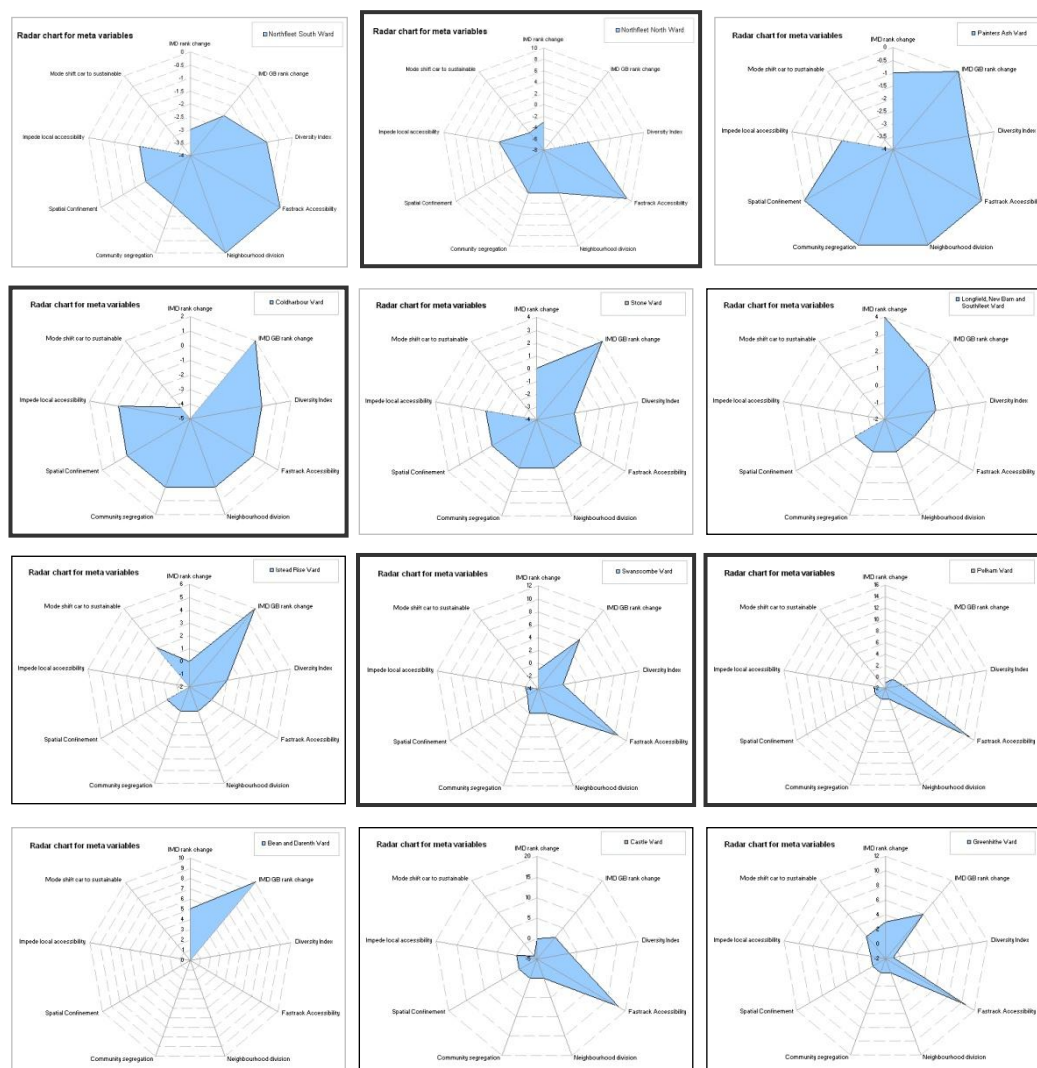


Fig. 8.27: Radar charts of 12 Ebbsfleet wards: combined impact scores. Ordered from most negative / least positive outcome (top left) to most positive / least negative outcome (bottom right).

Solid black line border: relatively most deprived (Carstairs score 2001) and hashed border: relatively least deprived.

8.1c

The Combined Scores indicator: Findings & critical assessment

The aim of the Combined Scores indicator

This cumulative indicator aimed to explore the summative effect of the impact indicators can provide planners and decision-makers with maps and associated charts to assess the hubs in terms of prioritising neighbourhoods with intervention measures to reduce social disbenefits, and promote favourable outcomes of the MUDP implementation.

The culmination of the input maps above was the Combined Score created to consider wards (or potentially smaller areal units in the future) that are potentially at risk from relatively adverse MUDP-related outcomes. Where the outcomes were more favourable this would allow planners to explore what lessons can be learnt to ameliorate areas with less benefits.

A tentative structure was suggested with which to visualise the combined impacts. Clearly the scoring was relatively arbitrary with which to grasp the extent that the impact or process was occurring at a coarse spatial (and sometimes temporal) resolution. Repeating the exercise with potential users such as at SEEDA or Gravesham Borough Council would provide invaluable feedback to improve the scoring, and final output maps interpretability and use.

The input values for the Combined Impact Scores were the outcome of the individual indicators described above from which a smaller 3km core analysis zone subset extracted. This subset of 'central' wards around the CTRL stations reduced the sample size, but allowed the assessment of the most immediate environs. One could be relatively more confident that any impacts measured were potentially the results of the MUDP, rather than the multitude of policy interventions that occur persistently in urban contexts regardless.

In Ashford, the 3km analysis zone coincided with the majority of the current urban core but excluded the planned expansion areas on the outskirts. In Ebbsfleet, the 3km zone was located between the edges of Dartford and Gravesend with smaller communities of Swanscombe, Greenhithe and Northfleet. It also includes the area expected to become the Ebbsfleet Valley development zone. The difference in the spatial configuration and demographics of the 3km zones provided a basis for considering which impact indicators were useful in different situations and which were more context specific (a main research question).

The Demographic Profile indicator output; the 'Index of Diversity' maps, are less successful than the other maps, in that they were vulnerable to the effects of ward size and different population densities. This was seen by the high impact score for Castle ward in Ebbsfleet, which only contained five OAs compared to the average of 17.5 OAs per ward in the 3km zone (which is c2.5 Std. Dev. difference). Carrying out a calculation for diversity at intra-LSOA or from the suggestion above in chapter 7.4, where the area of interest is defined manually to coincide with contextually defined 'neighbourhoods', as well as down-scaling to the 'Super Group' level OAC classification would be an improvement. Converting the output to standard deviations of the wider 10km analysis zone wards is useful in gaining a perspective on the 'average' level of diversity for that sample area, given that they were demographically quite different. This measure would be of use to ascertain if there was greater diversity following a new population influx relating to the start of the MUTP service. However any increase in diversity calculated from the 2011 census may well be witnessing general background changes of the population level typical for the area. Therefore as an MUTP impact tool, this is not so successful although it is an important input variable for the Community Cohesion indicator, where population turnover for Ebbsfleet is explored.

The Deprivation maps were presented as rank changes between IMD 2004 and IMD 2007, which provided a basis for considering entrenched deprivation, albeit relatively short-term in this time frame. This does however mask where absolute deprivation is, since it is possible to fall in rankings and still be relatively highly ranked overall (hence relatively not deprived) and similarly rise in rankings yet have a low ranking and therefore be considered a disadvantaged area. However there was no presumption that deprived areas to experience negative outcomes over less deprived areas, and the regression against the Carstairs Score in the final scattergraph plots supports this. The intention to identify areas that are not improving relative to other areas, particularly where other more negative impacts of the MUTP (in other maps) are occurring, is achieved with these output maps.

The Accessibility Measures implied a potential benefit was received by the new and proposed BRT services offered as feeder routes to the CTRL. The Ashford measure works well given the limitations of input data, although working at LSOA- rather than ward-level would have been preferable in order to have a clearer spatial distribution of the potential benefits of the bus routes. Reducing the Transport Needs Index and potential measure values to terciles for the combined score lead to a much more straightforward transformation of an impact score and worked well in both accessibility measures. Due to the added resolution that the dwelling location points brought to the Ebbsfleet accessibility measure, a greater degree of inclusion and exclusion at household-level occurred, which as discussed above, is artificial and possibly too blunt. However, the current method to score the wards is acceptable, reflects reasonably well the potential impact the Fastrack service will bring to those living close to the bus stops, excluding issues of affordability. Given that the

accessibility score is weighted by a factor of three and only positive (or null) values were assigned in this example, this had, in retrospect, the potential to bias the result and scoring the wards in with standard deviation of the mean level of accessibility for the 3km zone may have instead yielded a more rounded score.

The Physical Barrier indicator set outputs provided an interesting range of issues that were the hardest to reduce to simple scores, as these impacts do not lend themselves to hard quantification. The use of binary scores (zero for no perceived impact, and -1 for potential negative impact) reflected this uncertainty. Local planners would have a better 'feel' for the reality of these processes upon the local population. The inclusion of dwelling location points from OS MasterMap for the Ebbsfleet 'Neighbourhood Division' map (fig. 8.12), does accentuate the need for high spatial resolution data for these measures. Without them, the gross assumptions made in Ashford could prove to be wholly inaccurate, once again emphasising the strength of local knowledge in interpreting the outputs. Access to archived infrastructure maps would lead to measures that assessed changes over time before, during and after the MUP implementation. This is particularly of interest for the Impeded Access sub-indicator. Limiting the Impeded Access sub-indicator input to the 'Access to GP/Clinics' dataset could provide the added benefit of exploring this National Indicator (NI 175) for local planners.

The final individual impact indicator was the Sustainable Mode percentage change between 1991 and 2001 by ward in the 3km analysis zones, and the straightforward reassignment of the quintiles displayed in the maps to values between -3 to +1 so as to reflect the relative changes. If conducted at a higher spatial resolution, planners could see which areas required better provision and promotion of alternative sustainable modes of transport to the MUP interchange, or other key nodes on the network. Currently the impact scores are skewed towards the negative values, due to a rise in car use almost everywhere.

The combined maps for both Ashford and Ebbsfleet are illuminating despite the relatively arbitrary rating of the combined scores. They do capture the essence of the processes, costs, benefits, adverse and favourable outcomes sufficiently well to communicate the potential risk of negative impacts to a variable audience. The proliferation of wards with positive / few negative impacts around the centre of Ashford (fig. 8.20) is an interesting contrast to Ebbsfleet (fig. 8.25) where around the east of the station the wards are considered to have the most negative / least favourable outcomes. This implies that the combined scores are capable to drawing context-specific attention to areas that planners or decision-makers could consider positive interventions. The size of the wards does mask the intra-ward pattern, whereby it may be that a very small number of OAs or LSOAs are considered to be at risk of multiple negative impacts, highly localised and concentrated areas of MUP-related disadvantage (and vice versa for positive outcomes).

Future guidelines for planners and decision-makers

The scattergraph plots are a supplementary means of communicating the underlying patterns in the data that enables planners to consider the outcomes of the MUTP holistically. They contribute to achieving the indicator's main aim by providing data for a 'decision-makers response matrix' (fig. 8.22). This allowed wards to be positioned according to their deprivation score (Carstairs in this instance) against the weighted combined impact score. No correlation is proven; in Ebbsfleet it appears that some of the most deprived wards are those most at risk of the negative socio-economic outcomes, whilst the reverse is true in Ashford; those relatively least deprived benefit the least from the MUTP delivery.

The final visual 'tool' (produced in Excel solely) is the radar charts to examine the 'profile' of the combined impacts. The variation in axial scales (where zero – no noted impact or average value – is positioned differently on each graph depending on the value ranges) makes it harder to interpret. Yet the difference from the bulky negative/least positive outcomes to sliver-like positive/least negative outcomes is clear. Visualising the impact profile for each ward for the entire sample area is beneficial in identifying trends relating to individual indicators. For example it is easy to see the influence the scoring of SmartLink has on high positive outcome wards in Ashford (with a high R^2 value), or the negative effect of IMD rank changes has on adverse outcome wards in Ebbsfleet ($R^2 = 0.42$).

The banding and scoring schemes to create the Combined Score values and the subsequent weighted scores are the first attempt to quantify in the processes occurring at the hubs, and conflating complicated and complex patterns in the simplest terms for communicability and transparency, and provide the basis for comparison over a subsequent time period.

Ward Name	Unweighted Rank	Weighted Rank	Change
Stanhope	13 14 15	9 10	X
Aylesford	16	16	—
Beaver	11	12	√
Victoria	3 4 5	9 10	√
Norman	17	17	—
Bockhanger	8 9 10	15	√
Bybrook	8 9 10	7 8	—
Stour	6 7	11	√
Washford	3 4 5	1	X
S.Willesborough	8 9 10	13 14	√
N.Willesborough	1	2	√
Godinton	2	5	√
Singleton S	3 4 5	7 8	√
Little Burton	6 7	3	X
Highfield	13 14 15	13 14	—
Pk Farm N	12	4	X
Pk Farm S	13 14 15	6	X
Key: √ = improved rank with weighting — = no change X = declined rank with weighting			

Fig. 8.28: Ashford wards, from most to least deprived (Carstairs).
Combined Score ranking before and after weights applied (1 = most adverse outcome)

The weighting scheme in Ashford alters the rankings of the wards, more so than Ebbsfleet below. Only four wards remain unaltered in their rank, five fall in rank and eight improve (fig. 8.28). Park Farm North and South wards fall by around 8 rankings each, despite the high Diversity Index score (highly homogenous demographic) the result of low negative values for Sustainable Mode shift and no other perceivable impacts leads these wards to drop significantly. Victoria and Stour wards rise by around 6 rankings each, Victoria as a result of the high Accessibility measure for high transport need Output Areas within the ward boundary. Stour has a less significantly high Accessibility measure but rises in Geographical Barrier rankings too. Otherwise both Victoria and Stour wards have negative scores for IMD rank change and negative Diversity (above average demographic mix) and no impact recorded for Physical Barriers indicator and average Mode Shift. However the ward with the most favourable outcome, Norman, is ranked No.17 both pre- and post-weighting, and therefore can be considered a realistic impact profile interpretation. Similarly, the lowest, least favourable outcome wards, North Willesborough and Washford remain very low ranking before and after the application of the weighting scheme.

Ward Name	Unweighted Rank	Weighted Rank	Change
Northfleet N	2	2	—
Pelham	7/8/9	9	—
Coldharbour	3	4	√
Swanscombe	6	8	√
Northfleet S	1	1	—
Stone	5	5	—
Bean	12	10	X
Painters	4	3	X
Greenhithe	11	12	√
Castle	10	11	√
Istead	7/8/9	7	—
Longfield	7/8/9	6	X
Key: √ = improved rank with weighting — = no change X = declined rank with weighting			

Fig. 8.29: Ebbsfleet wards, from most to least deprived (Carstairs).

Combined Score ranking before and after weights applied (1 = most adverse outcome)

The weighting scheme generally makes little change in rankings, with five of the twelve wards in Ebbsfleet remaining the same, three declining in rank position and the remaining four improving (fig. 8.29). Most wards only change by one rank position, although Swanscombe rises two places (due to positive Accessibility measure and positive Geographical Barrier ranking changes). Bean ward has the most favourable / least negative outcomes before the weighting scheme only to fall two places, since this ward has no perceivable positive or negative impacts for any of the indicators save two positive ranking changes from the IMD and Geographical Barriers. It is superseded for top place by Greenhithe ward, which has positive impacts resulting from the Fastrack feeder and increased Sustainable Mode shift between 1991 and 2001.

The current format for the Combined Scores would be simple to amend should some indicators prove to be considered more complex and greater rigour is required to make sense of them, although the basic issues are communicated well with the current map outputs. One potential alternative weighting scheme would be to assign a weight relative to the position of the process in the *Cynefin* framework. Processes that are 'known' and therefore predictable could be weighted by a factor of 3 (e.g.: Accessibility variables which are scored 3 in the current scheme), 'knowable' processes a factor of 2 as their cause and effect may be perceivable over a long time frame (e.g.: Social Exclusion, Journey to Work Mode, Deprivation). Finally those in the 'complex' process domain are assigned a value of 1, given their emergent properties and ambiguous relationship to the decision-making outcomes (e.g.: Diversity, Migration and Spatial Confinement).

Future lessons learnt for Decision-makers and planners

The outcome of the Combined Score is highly context specific, the interplay of the various sub-indicators at set spatial scales and sampling levels all contribute to impact maps that require much understanding of the dynamics of the input datasets. However, two related generic lessons can be extracted for future consideration in the application of the method to a new case study MUP. The first insight relates to the shortcomings of the scoring whereby a ward with almost no impact at all can be ranked as having an overall favourable impact (cf. Victoria and Aylesford wards in Ashford, Pelham and Bean wards in Ebbsfleet). A more helpful insight for decision-makers is that there is very little correlation between the level of deprivation and the outcome of the MUP impacts, seen by the low R^2 values (see figs. 8.21 and 8.26). In Ashford, some of the least deprived wards appear to have the relatively least favourable / most adverse outcome and vice versa for those most deprived. In Ebbsfleet the relationship is more complex; those most relatively deprived also have the least favourable MUP outcomes. Yet the R^2 value is even lower ($R^2=0.18$), suggesting that this is as good as random chance, and therefore likely to be the result of context-specific demographic and spatial configuration of the hub community. Lessons learnt from the Combined Score methodology particularly relating to the input values, are implemented for the meta theme scores below, with the adoption of a standard deviation of a sample mean as a scoring system. The emergent properties of this Combined Score suggest that this process resides in the 'complex' decision-making domain of the *Cynefin* framework. Details are unpredictable and patterns will not repeat, and therefore, as with other complex processes, amplification of positive outcomes and dampening of the negative is an appropriate management strategy for planners.

8.2a

The Meta Theme indicators:

Methodology

This final indicator is carried out solely for Ebbsfleet as there are much wider social impacts potentially going to occur due to the regeneration of the area. Alongside the datasets created for the Combined Score indicator (chapter 8.1), further supplementary maps and charts can be created in order to consider if they can contribute to understanding two 'meta themes', community cohesion and social exclusion. These two indicators are presented as an experimental exercise to understand some of the underlying patterns of socio-economic facets that are considered to contribute towards increases or decreases in cohesion and exclusion (see the literary review sections 2.1 and 2.2). These indicators also considers the added value or cost that the delivery of the MUTP could make in theory, assuming planners and decision-makers are able to understand the sometimes complex link between cause and effect.

The meta themes maps illustrate those areas that are most at potential risk of low cohesion and/or high exclusion, with a range of values that can be interpreted as two ends of a spectrum; 'significant concern, action required' to 'potential example of good practice from which we can learn'. A scattergraph plots ward scores for community cohesion against social exclusion (although no assumption is made that they bear influence upon one another) in order to consider an alternative version of the decision-makers 'response matrix' (fig. 8.22)

Potential benefits for the MUTP appraisal

The MUTP could provide the catalyst to improve cohesion and decrease exclusion.

- *Improved community cohesion:* could lead to more optimism, financial investment, regeneration, lower population turnover and reduced deprivation.
- *Reduced unemployment-related social exclusion:* by providing better affordable accessibility, more job opportunities and increased employment locations in the area.

Aim of the indicator

The aim of the meta theme indicators is to help planners explore if and where there are relative risks of low community cohesion and/or high social exclusion within Ebbsfleet, and whether the MUTP, and its associated developments and infrastructure, changes that potential risk. Current Planning Support Systems do not provide an environment for exploring such complex issues. These meta theme indicators are a powerful visualisation

method to consider the wide-ranging effect an MUTP could have on the whole community, and provides policy- and decision-makers with a fresh approach to facilitate improvements.

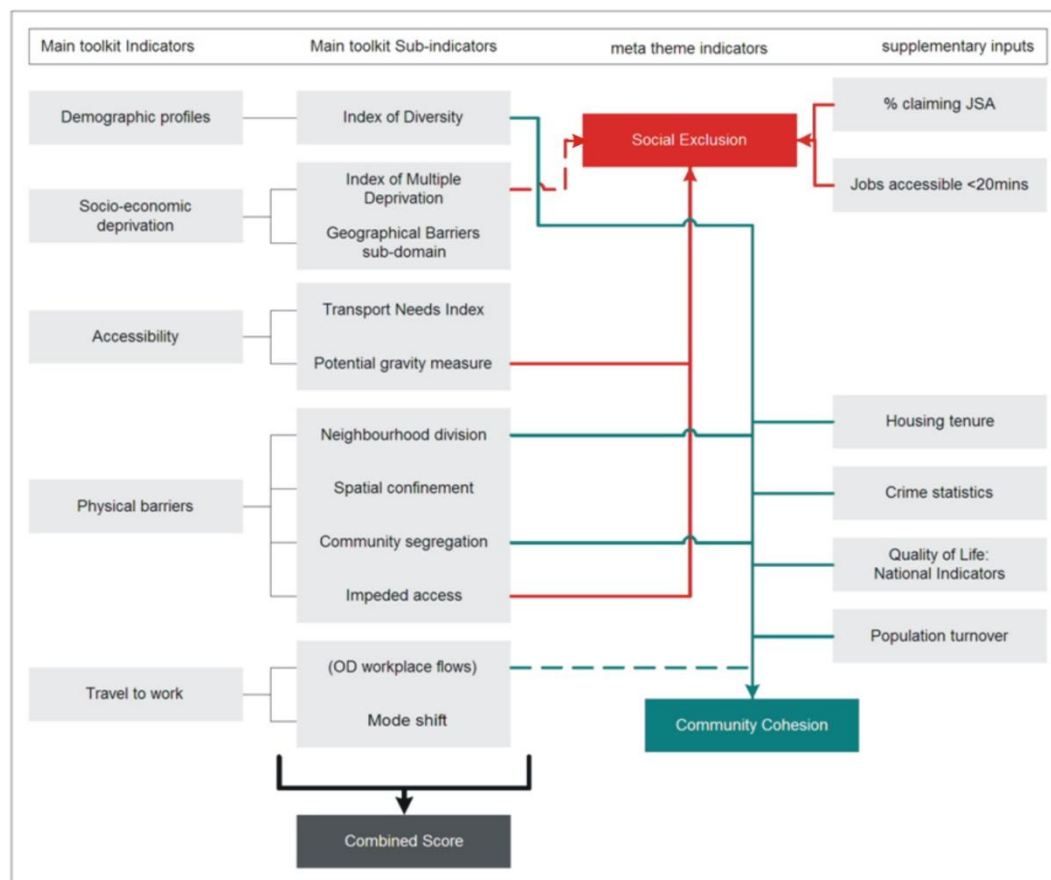


Fig. 8.30: The input indicators of the indicator set and meta themes of community cohesion and social exclusion (dashed line means a partial input)

Objectives

- To extract a spatially defined sample of the relevant sub-indicators from the preceding indicator sets (as illustrated above fig. 8.30) for Ebbsfleet only.
- To generate supplementary indirectly MUTP-related socio-economic datasets that provide differing facets of the meta themes; cohesion and exclusion, in Ebbsfleet.

Method for the Community Cohesion indicator: 'at risk' wards in Ebbsfleet

The Index of Demographic Diversity, which seeks to establish changes in the demographic profile of the hubs during and after the implementation of the MUTP, is presented at intra-ward level for Ebbsfleet as a base data set. There is an implicit expectation that the higher the demographic mix, the lower the community cohesion (Jordahl 2009, Kossinets and Watts 2009). The subsequent map also considers diversity, the mix of housing tenure within a ward. House tenure diversity; has been cited as a factor in reducing deprivation and population turnover, leading to higher satisfaction with one's community (Bailey and Manzi 2008). The tenure values are extracted at ward level from the 2001 Census (Key Statistic

table 18) and reveal the ambiguity that a mixture of people can contribute to a community; that high 'diversity' appears to have beneficial and adverse impacts on cohesion.

To the diversity maps, one can add the Kent Police Force's crime statistics (in this example the mean for April-June 2007 to April-June 2008 figures) to explore 'cohesion'. These statistics cover all reported crimes by the victim (therefore excluding murder), including robberies, thefts, assault, car crime and anti-social behaviour (Kent Police 2008) (Hirschfield and Bowers 1997, Putnam 2007).

The next input dataset for community cohesion incorporates the internal migration rates compiled by the ONS Small Area Population Estimation (SAPE) team and published on the Neighbourhood Statistics website [www.neighbourhood.statistics.gov.uk]. These calculate the estimated flow of residents (where their postcode of address on June 30 is different from their postcode one year previously) via GP Patients Registers, thought to be a good proxy for internal migration patterns (O.N.S. 2010:1.1 & 3.2). The net population increases or decreases per Middle Super Output Areas (MSOAs) 2008-2009 per 1000 residents are initially provided for the Ebbsfleet 10km analysis zone. This is followed by mid-2006 to mid-2007, mid-2007 to mid-2008 and mid-2008 to mid-2009 *turnover* per 1000 residents of all ages to provide a pre-, during and post-MUTP delivery profile of population movement at the hub. These maps are displayed at MSOA-level and are followed by a final MSOA map illustrating the range of standard deviation (Std. Dev.) of each MSOA's 2008-09 values from the mean for the whole of Kent over the three years. This is to assess if the hub has had a larger than regional average influx or departure of residents (or both) in the year following the MUTP delivery. It can also reveal the pattern population 'turnover' vs. stability, relevant to the theme of social cohesion.

The definition of population turnover by the ONS takes the average of three consecutive years to mitigate against large land-use changes (Dennett and Stillwell 2008). However, we are interested in the long-term year on year changes as a result of the MUTP and its associated land-use changes once/if the Ebbsfleet Valley development is built and occupied. 'Turnover' is in contrast to population 'churn', defined as the in/out *inter-district* turnover volume in addition to the movement *intra-district* (ibid.), and therefore brings the issue of choosing scale and the capturing the relevant dynamics of people migrating to the fore. An attempt is made to establish at what scale the migration impact of the MUTP against other pull/push factors that influence localised (intra-district) migration, for example school catchment areas or a need for greater living space, or international migration, such as new employment or family. An assumption is made based upon the outcomes of other MUTP impact studies (for example in chapters 3 and 5), that the impact of an MUTP would be detectable in 'internal' level figures, that is, between MSOAs. Further meta-data regarding

the production and associated accuracy issues of these data by the ONS SAPE team are provided in their methodology publication (O.N.S. 2010).

In order to produce a population turnover score for the Community Cohesion metric, the values for the standard deviation of each MSOAs' 2008-09 values vs. the mean for the whole of Kent over the three years are given a value ranging between -2 (for >1.5 Std. Dev. above the Kent mean and therefore a high turnover) to 1 (<-1.5 Std. Dev. below the Kent mean and therefore below average turnover). These values were then assigned to the OA centroids that are nested within each MSOA, and re-aggregated upwards to their respective 2001 wards as listed in the census geography look-up tables (O.N.S. 2008), as OAs belong to both MSOAs and wards. Detailed ward-level origin-destination migration flows derived from the censuses are available from WICID (Special Migration Statistics Level 2) but the resources required to process the data exceeded their usefulness for the purposes of this impact indicator. However if an area was displaying particularly higher or lower than average turnover, assessment of where the residents were choosing to relocate to or from could provide planners and decision-makers with supplementary data to stabilise the turnover.

The final non-MUTP related datasets in this theme are collected at council borough-level, and map (fig. 8.51) clarifies which wards in the Ebbsfleet 3km analysis zone fall under Dartford Borough Council and which under Gravesham. The National Indicator Set outcomes for five indicators are explored that have a strong theme of community cohesion inherent in the questions. This rich dataset was collected by Local Authorities following the Government's Comprehensive Spending Review in 2007, and supersedes the Best Value Performance Indicators and the Performance Assessment Frameworks. The aim of these National Indicators was to publish the output of a biennial Place Survey (by post) to monitor the progress of the district boroughs against one another and identify problem areas that require attention spatially and over time. The National Indicators were cancelled as of May 2010. The detailed rationale behind the indicators chosen for the community cohesion meta score is taken from the Audit Commission FAQs regarding the datasets (Audit Commission 2009) and located within appendix 10.21

The MUTP-related Physical Barriers sub-indicators of Neighbourhood Division and Community Segregation are the 'added cost/value' variables, whereby the fragmentation of an existing neighbourhood and/or the construction and inhabitation of a new community besides an existing community of greatly differing demographics can both lead to lower community cohesion (C.I.C. 2007b, D.C.L.G. 2008b). These are extracted from the preceding Combined Scores indicator set (chapter 8.1); binary values of 0 for no perceivable impact, to -1 for potential negative impact.

Method for the Social Exclusion indicator: 'at risk' wards in Ebbsfleet

Selecting social exclusion due to joblessness from the many facets of social exclusion provides an opportunity to explore how the MUTP and associated changes at Ebbsfleet can improve or decrease the risk of this socio-economic phenomenon through changes in accessibility. The non-MUTP related indicators from the preceding indicator set to be included for this meta theme includes the Income Domain (as standard deviations from the 10km analysis zone mean, and rank changes between 2004 and 2007 to assess 'entrenched income-related deprivation'), drawn from the Indices of Multiple Deprivation. The Income Domain in IMD07 refers to the percentage of the population who are in receipt of means-tested government benefits and the input variables are as follows:

- Adults and children in Income Support Households (Source: DWP 2005)
- Adults and children in Income-Based Job Seekers Allowance Households (Source: DWP 2005)
- Adults and children in Pension Credit (Guarantee) Households (Source: DWP 2005)
- Adults and children in those Working Tax Credit households where there are children in receipt of Child Tax Credit whose equivalised income (excluding housing benefits) is below 60 per cent of the median before housing costs (Source: HMRC 2005)
- Adults and children in Child Tax Credit Households (who are not eligible for IS, Income-Based JSA, Pension Credit or Working Tax Credit) whose equivalised income (excluding housing benefits) is below 60 per cent of the median before housing costs (Source: HMRC 2005)
- National Asylum Support Service (NASS) supported asylum seekers in England in receipt of subsistence support, accommodation support, or both (Source: NASS 2005) (D.C.L.G. 2007a)

The D.C.L.G. applied a disclosure control to the Income Domain scores whereby counts with underlying numerator counts of less than three persons have been suppressed by setting them to zero so as to protect privacy. The use of the Income Domain rather than the whole IMD allows the inclusion of a variable related to poverty but offsets the issue of 'double counting' with the IMD Employment Domain (which accounts for 22.5% of the IMD), and new employment-related datasets described below.

The supplementary data for the Social Exclusion indicator are both extracted from the 2008 Accessibility Indicators, Employment sub-domain (published by the Dept. for Transport 2009). This is a rich source of data at LSOA level, with a variety of indicators ranging from 'travel time to nearest employment centre by cycle', and 'risk population within 20 minutes by car' to 'percentage of target population within 40 minutes by composite mode'. The first indicator selected is an estimation of the level of unemployment in the LSOAs (aggregated to ward later); 'the number of those claiming Job Seekers Allowance (JSA) as a percentage of the working population', presented for the 3km zone. This links to the supposition that areas with higher numbers of JSA claimants (a proxy here for unemployment levels) are a population 'at risk' of social exclusion due to joblessness.

The second indicator is a localised sub-variable of the government's National Indicator Set (described above) number 176 (NI 176) and displays the number of jobs accessible by any form of public transport or walking (in this version, within 20 minutes), banded 0-3 (from <500 to >5000 jobs accessible). This 'Origin Threshold Indicator' (as opposed to a Destination Indicator, either as 'Threshold'/banded or 'Continuous' measures, which offer different perspectives on the same issues) is also at LSOA-level. The 'origin' was chosen as the focus of interest is upon the population living in the LSOA rather than the jobs within the LSOA. The predefined thresholds provide clear scoring bands for the indicator and provide repeatable uses for a different context. This variable is displayed for the 10km analysis zone to explore the wider pattern of this variable, although only wards in the 3km zone are incorporated into the Community Cohesion indicator. This latter input highlights areas that are not as well served by non-car transport for jobs, although there is no distinction between job types. Therefore this serves as an approximation of potential employment accessibility related to local public transport density and walking distances.

The 2008 Core National Accessibility Indicators technical report provides the metadata concerning the in-depth calculations and variables utilised in the accessibility measures (fig. 8.31). These indicators are generated to help Local Authorities comprehend journey-time barriers to accessing a range of facilities and opportunities, and generate a baseline to improve accessibility targets (particularly if accessibility levels are one of their Local Area Agreement targets). Furthermore, NI 176 is regarded as having a role to play in facilitating social inclusion, enabling integration into the Local Transport Plan to improve poor access to a range of facilities (Audit Commission 2010).

Data sources (from the 2008 Technical Notes):

Service	Data source for the locations of the service	Data source for the target population of the service	Data source for the 'at risk' population of the service
Employment	Data: No. of jobs available in a LSOA. Source: ONS Annual Business Inquiry Further information: http://www.statistics.gov.uk/abi/	Data: Number of 16-74 year olds in each output area Source: 2001 Census + LSOA updates from ONS 2008 mid year population estimates Further information: Census Key Statistic Table 02: https://www.nomisweb.co.uk/home/census2001.asp ONS Mid year population estimates: http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=14357	Data: Number of people in receipt of jobseekers allowance in each lower super output area in December 2008. Source: DWP Jobseekers allowance claimant data Further information: http://83.244.183.180/NESS/WACG/wacg.htm

Fig. 8.31: D.F.T. metadata for the National Indicator NI176 (derived from D.f.T. 2009b)

The MUTP-related 'added value' indicators are both accessibility measures; the potential gravity-based measure for the Fastrack B feeder bus route and the Impeded Access sub-indicator from Physical Barriers indicator, both of which explore access changes to facilities and/or employment opportunities through the MUTP itself or related infrastructure, reinforcing the proposed link between accessibility and social exclusion (Hine and Mitchell 2001, Miller 2003, Social Exclusion Unit 2003).

Future guidelines for planners and decision-makers

A new 'decision-makers response matrix' is presented for the meta theme scores, again to prioritise areas where intervention should happen if political will and financial resources are favourable. Improvements to community cohesion can include a stabilisation of the population turnover, reduction of crime levels, and empathetic management of the severance of neighbourhoods during the MUTP construction and delivery. Improvements to areas with potentially high-risk populations for exclusion include improving accessibility by sustainable and affordable modes to more employment opportunities possibly through MUTP-related changes in the area.

Lessons Learnt for planners & decision-makers

Much like the Combined Score, the potential risk of increased or decreased cohesion and/or exclusion is unique to this case-study. Community cohesion can be considered 'complex' process whereby planners can 'Probe-Sense-Respond', and where narrative or questionnaires from the residents is a viable and powerful method of extracting knowledge for this issue.

Social exclusion due to joblessness tends more to being a 'knowable' process, and systems thinking approach is a viable way to reduce this. Scenario-planning the complicated, but relatively predictable actions is possible if based upon established good practice for improving affordable accessibility for populations with high public transport needs, and increasing access to potential job locations.

8.2b

The Meta Theme indicator: Input data and output maps

The Community Cohesion sub-indicator

The first map (fig. 8.32) illustrates the variety of tenure at ward level and clarifies areas that have higher rentals from local authorities (western Gravesend) and where mortgages and/or outright ownership are higher (southern areas and eastern Dartford). Fig. 8.33 (below) provides a further breakdown of all the types per ward.

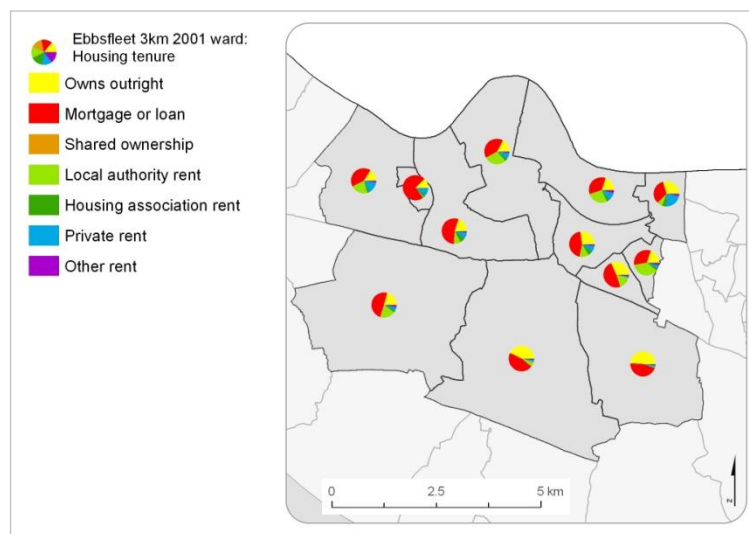


Fig. 8.32: Housing Tenure proportions in Ebbsfleet 3km analysis zone (Census 2001 KS18) [2001 Census ONS & ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

As mentioned in the methodology section above (8.2a), this diversity of tenure can prove beneficial in reducing overall deprivation and population turnover, and can potentially improve overall satisfaction with one's neighbourhood. However in many cases the impact of this is at odds with the hypothesised negative impact the diversity of demographic types in a community, although undoubtedly this ambiguity exists in reality, it becomes awkward to quantify these opposing effects that reflect this complex interaction.

The associated Simpson's Index of Diversity standard deviations from the 3km zone mean (fig. 8.34 below) for mix of housing tenure can be interpreted as the higher the index value, the higher the tenure mix and therefore the lower the risk of population turnover and high deprivation, which in theory could lead to lower risk of poor community cohesion.

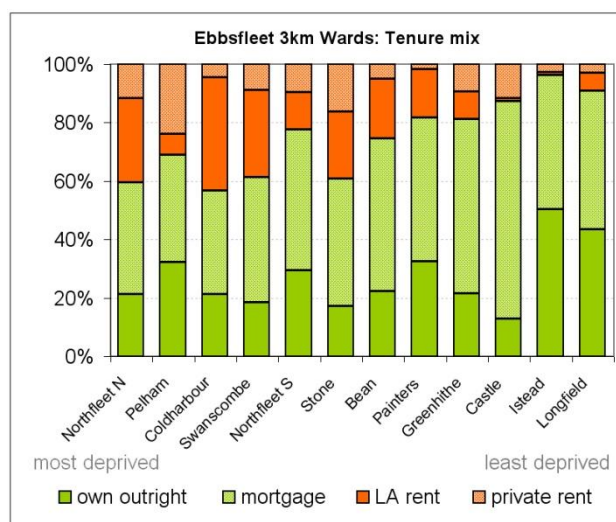


Fig. 8.33: Bar chart for major housing tenure types in Ebbsfleet 3km zone

Application of the same assessment method for this new Index of Diversity for tenure, is carried out as for Demographic Diversity (e.g. fig. 8.03 in the Combined Score indicator 8.1b). Ranging from >0.5 Std. Dev. (a high relative diversity) scored 1, to <1.5 Std. Dev. (a low relative diversity) scored -2, results in scores that suggests 'diversity' (demographic and tenure together) leaves many wards with a combined neutral score of zero, discussed in greater depth within the Findings section (8.2c).

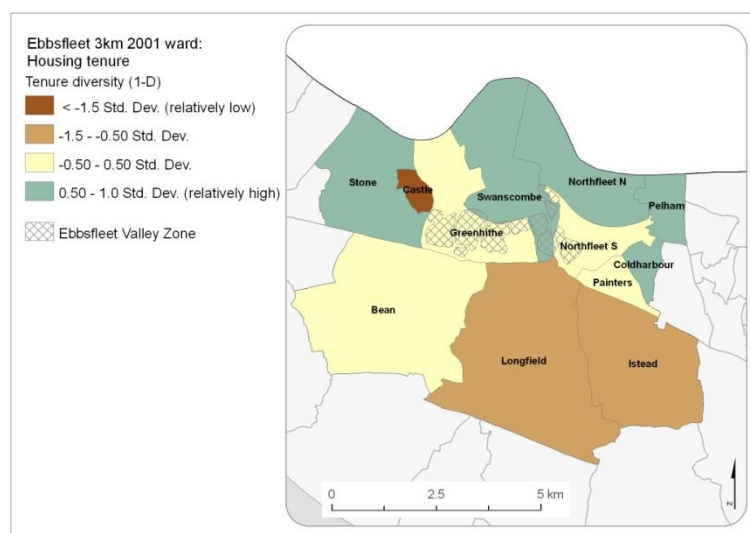


Fig. 8.34: Housing Tenure diversity index. Standard Deviations from the 3km zone mean in Ebbsfleet [2001 Census
ONS & ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The Kent Police Force's crime statistics (in this example the mean for 2007-2008 figures for all crimes reported) are extracted for Ebbsfleet at ward level:

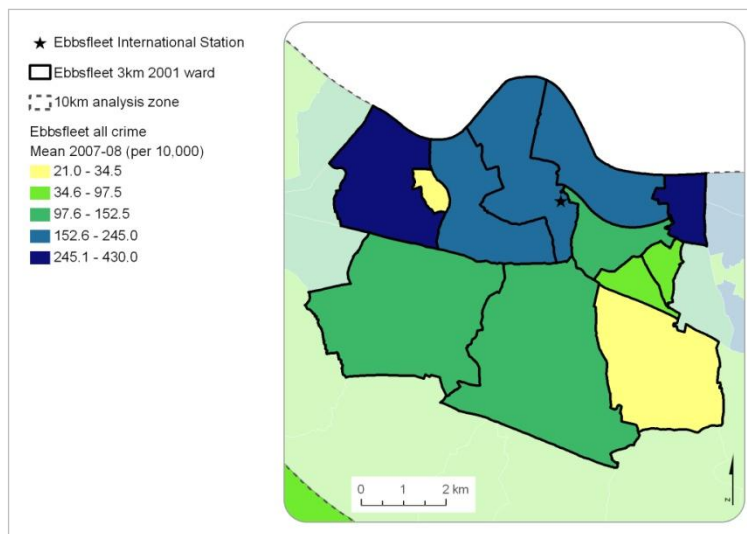


Fig. 8.35: Ebbsfleet 3km zone, average crime statistics per 2001 ward [© Kent County Constabulary 2009 / www.ukcrimestats.com & ONS ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The highest level of crime, as per 10,000 of the total population, are concentrated along the Thames river front, the two highest at the edges of the high density areas of Dartford (west) and Gravesend (east), with a pocket of low reported crime in the small Castle ward (fig. 8.35). The southern and south-eastern zone wards are relatively low crime. These values were transformed to standard deviations from the mean for the 10km analysis zone (fig. 8.36 below), and areas that scored <0.5 Std. Dev. (a low crime rate) received a value of +1, to wards that had a Std. Dev. of >1.5 (relatively high crime rates) receiving a score of -2 for the Cohesion Score.

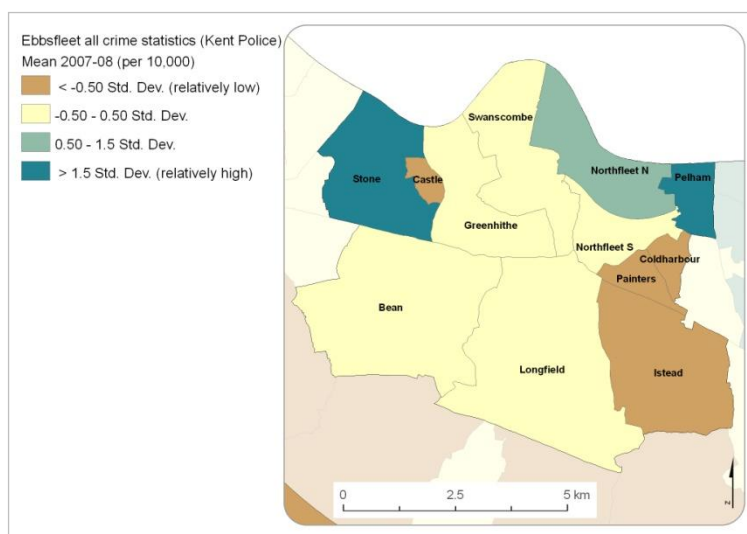


Fig. 8.36: Ebbsfleet 3km zone, average crime statistics per 2001 ward. Std Dev from 10km mean [ONS ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The penultimate mapset explores the population turnover at the core Ebbsfleet analysis zone, considering the inflow and outflow of residents.

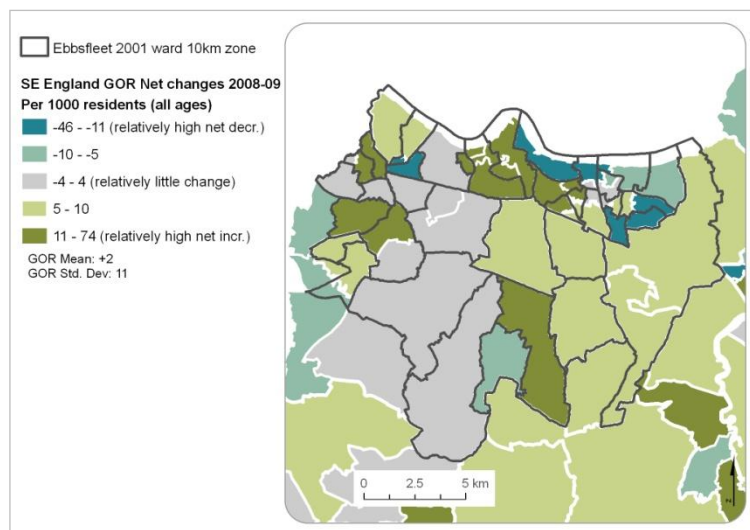


Fig. 8.37: Ebbsfleet 10km zone wards & SE GOR population changes per 1000 residents all ages mid-2008-2009 [ONS Population Turnover Neighbourhood statistics: Open Government Licence & ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The ONS release mid year population estimates including the net changes in the population. Here central Dartford (in the north-west) and Gravesend (in the north-east) see net decreases of over 1% between mid-2008 and mid-2009 (fig. 8.37). They are surrounded by Middle Super Output Areas (MSOAs) of net increases as well as some areas that have changed relatively little. Aside from the decreases in Gravesend itself, the rest of the eastern portion of the 10km zone sees generally modest net increases and the western portion a more static population level for the 12 months. Whilst these data inform planners where the population is rising and falling overall, it masks the extent of inflow and outflow of people to and from a ward. The mid-year population turnover data from the ONS, released at Middle Super Output Area level, is not directly comparable to ward boundary definitions (fig. 8.38).

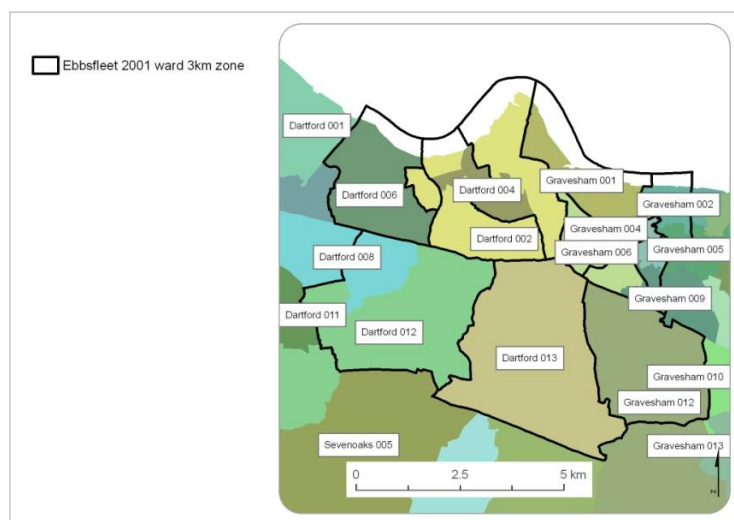


Fig. 8.38: Ebbsfleet 3km 2001 ward boundary outlines and 2004 MSOA boundary polygons [©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Therefore, initially a subset of the MSOAs surrounding the CTRL station at Ebbsfleet was created, resulting in twelve MSOAs with which to explore the inflow, outflow and turnover of residents at the hub.

Extracting the most recent three year periods (mid-2006 to mid-2007, mid 2007 to mid-2008 and mid-2008 to mid-2009) released by the ONS covers the pre-, during and post- CTRL/HS1 delivery at Ebbsfleet. Displayed below are the maps illustrating the level of turnover (inflow+outflow per 1000 residents of all ages) in each MSOA. The pattern remains broadly the same over the three periods (see figs. 8.39-8.41 below), whereby the north-eastern areas see the highest turnover. This is followed by the north-west, then south-west and lastly, the south-easterly MSOAs, which have the lowest turnover levels. Note that abbreviated labels are provided for the MSOAs; D denotes a Dartford MSOA, and G a Gravesham MSOA.

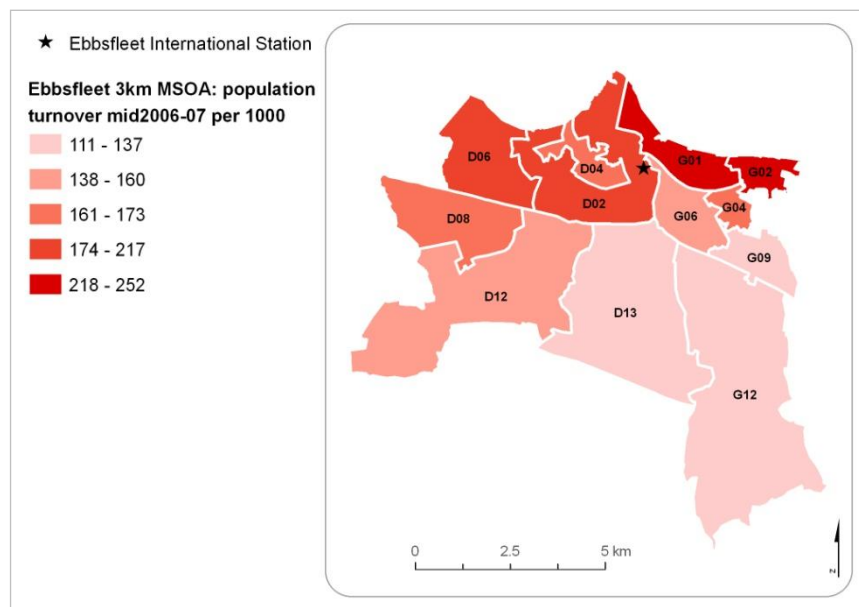


Fig. 8.39: Ebbsfleet 3km zone MSOA: population turnover per 1000 mid-2006-2007 [ONS 2001 Census aggregate data (Edition: 2005). UK Data Service / ©Crown copyright 2003 / UK Borders]

Illustrating the inflow, outflow and turnover data for all MSOAs in the 3km zone (see figs.8.42 and 8.43) suggests that for many of the MSOAs, there was a higher inflow and outflow (and therefore turnover) in the period 2006-2007 than in the subsequent data capture periods.

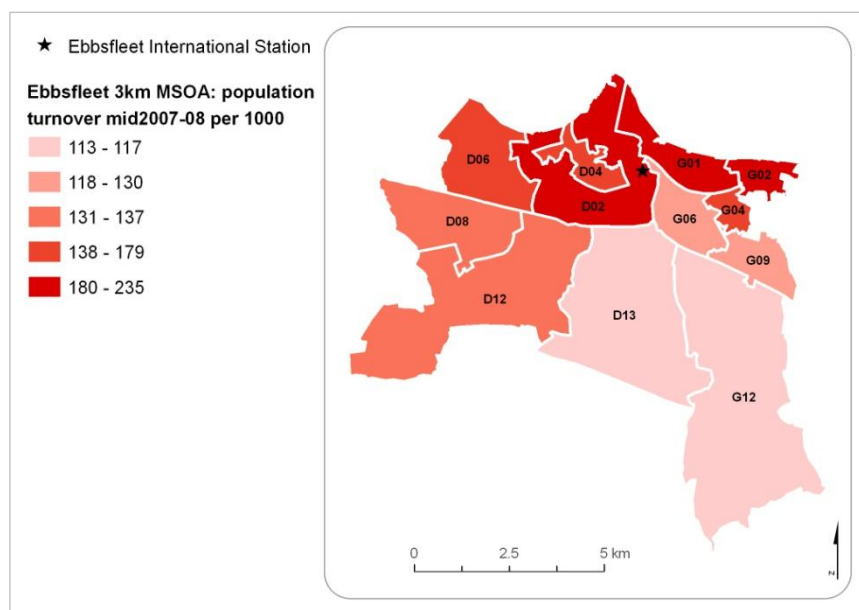


Fig. 8.40: Ebbsfleet 3km zone MSOA: population turnover per 1000 mid-2007-2008 [ONS 2001 Census aggregate data (Edition: 2005). UK Data Service / ©Crown copyright 2003 / UK Borders]

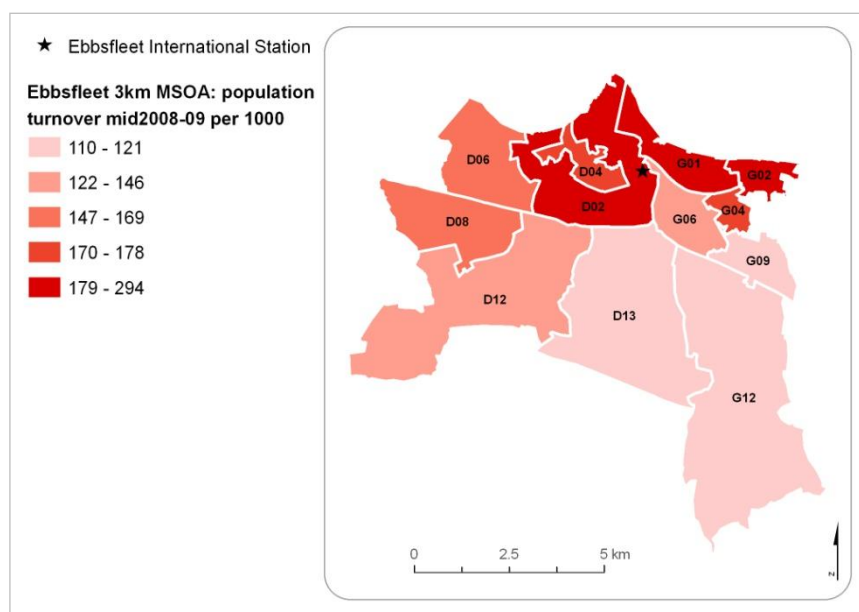
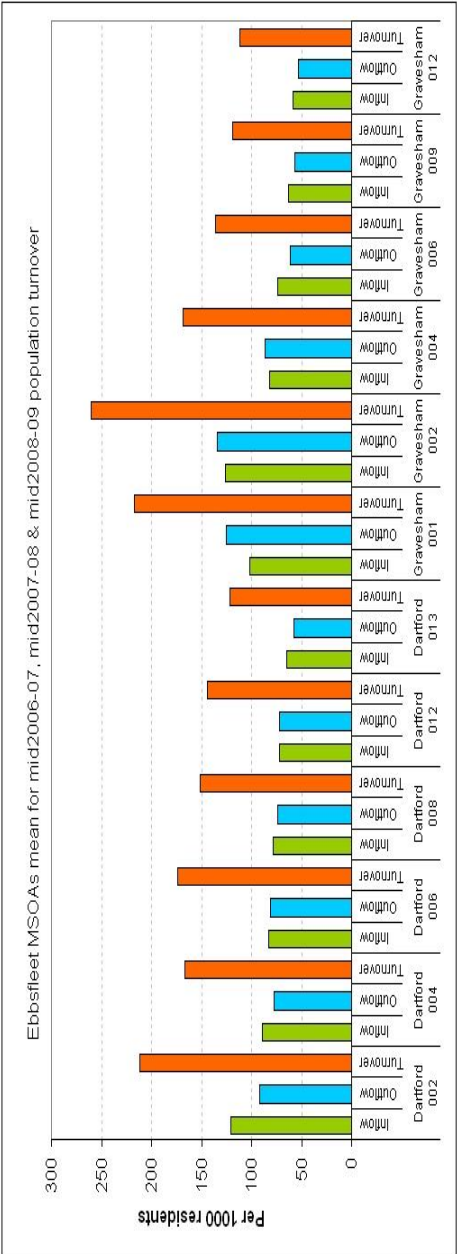
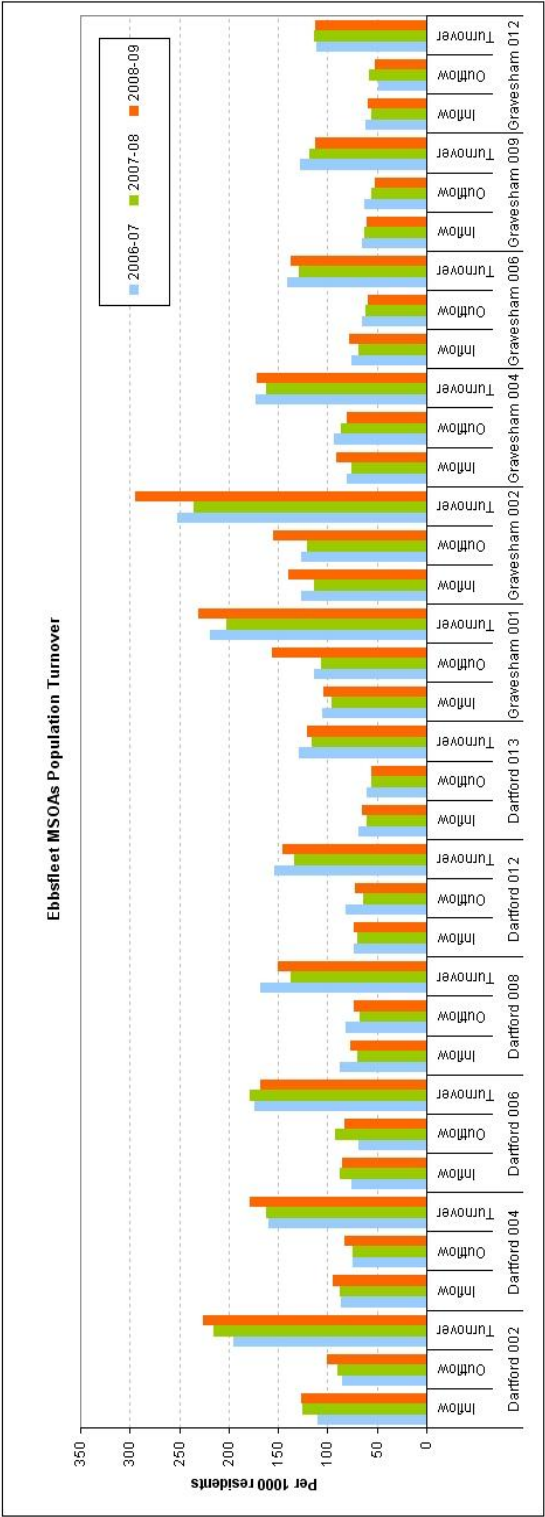
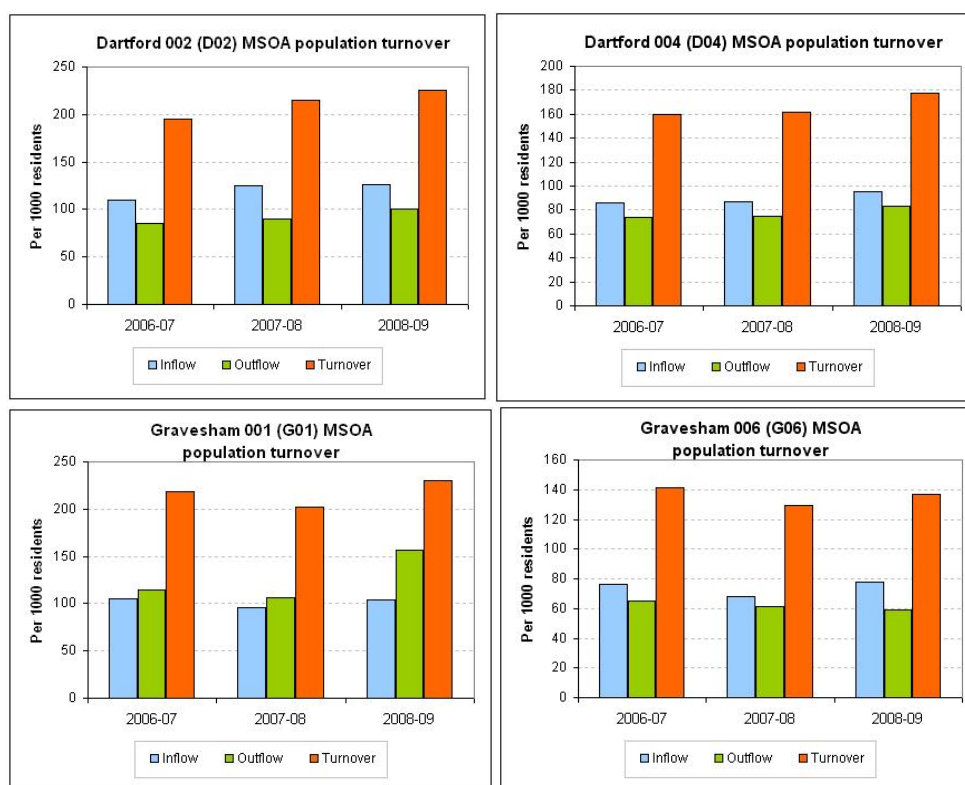


Fig. 8.41: Ebbsfleet 3km zone MSOA: population turnover per 1000 mid-2008-2009 [ONS 2001 Census aggregate data (Edition: 2005). UK Data Service / ©Crown copyright 2003 / UK Borders]

With reference to figs 8.42-43 below, the MSOAs with the three highest inflows are Dartford 02 (D02) and Gravesham 01 and 02 (G01 and G02). They also have the highest population turnover, although Dartford would appear to have a net increase, whilst Gravesham 01 and 02 a net decrease in population levels, particularly in the final period. Furthermore Dartford 06 (D06) and Gravesham 04 (G04) also have mean population outflows at least as high as their mean inflows and relatively higher than other MSOAs.



Figs. 8.42 & 8.43: Ebbsfleet MSOAs inflow, outflow and turnover (breakdown per year & 3 year mean)



Figs. 8.44-8.47: Ebbsfleet CTRL core MSOAs: population inflow, outflow & turnover for 3 years

The four MSOAs immediately surrounding the CTRL station are Dartford 02 and 04, and Gravesham 01 and 06. Taking a closer look at their turnover data (figs. 8.44-8.47), it would appear that all have net increases except Gravesham 01, which has experienced a decrease in population levels for the three periods, although the last period saw the decrease widen. Regarding solely turnover rates, Dartford 02 and Gravesham 01 have both have high turnover relative to the rest of the 10km zone (almost consistently over 200 per 1000 residents). Dartford 04 has medium levels of turnover although the latest period had the highest, whilst Gravesham 06 has medium-low turnover and the final period was lower than the 2006-07 period. As the Ebbsfleet Valley development is not yet constructed it is possibly not surprising that there is no significant inflow seen here, but is the turnover greater than average for the region?

Calculating the mean population turnover for all of the MSOAs within the County of Kent for the three year period (mid-2006 to mid-2009, calculations are located in the appendix 10.22) provides a base level with which to consider the 2008-08 Ebbsfleet turnover, following the delivery of the CTRL.

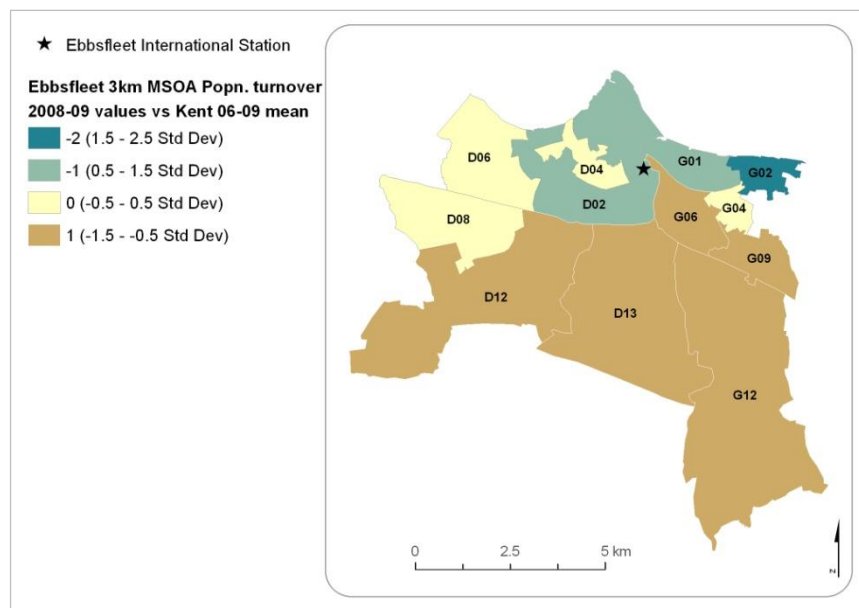


Fig. 8.48: Ebbsfleet 3km zone MSOAs: scores for the standard deviation from the Kent 3 year mean [©Crown copyright 2003 / UK Borders]

Fig. 8.48 above alludes to a relatively stable population turnover level for the region, with five of the twelve MSOAs seeing less turnover in 2008-09 than the Kent three year average, four MSOAs experiencing average levels, two MSOAs slightly more than average and only one, Gravesham 02 seeing a higher than average turnover (and a net mean decrease over the same period). To transform these findings to values for the Community Cohesion score, Census geography look-up tables were used (O.N.S. 2008). The smaller Output Areas that are nested within these MSOAs were assigned the same score relating to the standard deviation range (see the legend in fig. 8.48 above and fig. 8.49 below). These OAs were subsequently re-aggregated into the twelve Ebbsfleet analysis zone wards (as per the census look-up tables) and each ward assigned the mean of the OAs' scores (fig. 8.50 below).

The final scoring scheme for this input assigns a value of +1 for wards with below average turnover, 0 for average turnover, -1 for slightly higher than average and -2 for significantly higher than the average level of turnover for Kent between 2006 and 2009. The transparency and repeatable nature of this transformation allows the process to be extended to other areas with ease. Whilst this certainly introduces a further level of data abstraction, and possible errors as inter-MSOA migration could be intra-ward and vice-versa, these maps and score values provide an elementary picture of the movement of people around Ebbsfleet.

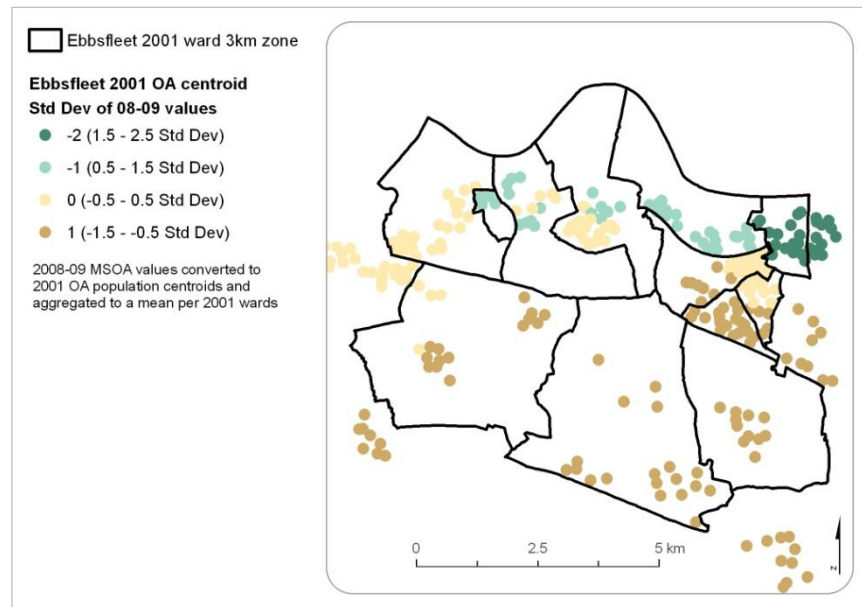


Fig. 8.49: Ebbsfleet 3km zone OA centroids: scores for the standard deviation from the Kent 3 year mean [©Crown copyright 2003 / UK Borders]

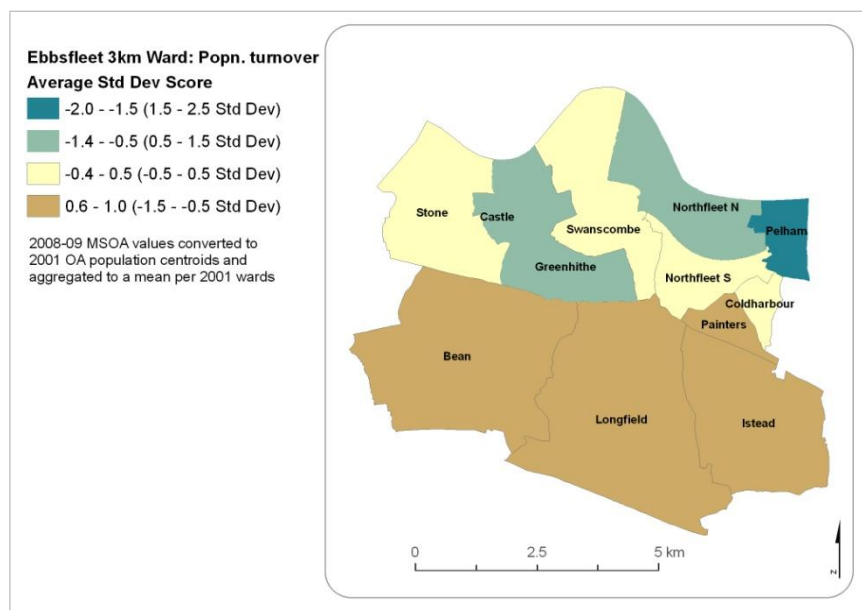


Fig. 8.50: Ebbsfleet 3km zone wards: re-aggregation of the OA centroid values:
Std. Dev. from the Kent 3 year mean [©Crown copyright 2003 / UK Borders]

Whilst the ward with the relatively lowest mix of housing tenure does have a higher than Kent County three-year average population turnover (Castle ward) in 2008-09 (fig. 8.50), wards with higher levels of population turnover are those with the highest levels of mixed tenure when plotted on a scattergraph (fig. 8.51). Similarly those with lower than the Ebbsfleet 10km zone average housing tenure mix, also have relatively low turnover, but the R^2 coefficient (0.07) indicates that this is essentially a random coincidence. Evidently complex local-level population turnover dynamics are shaping these processes, negating the potentially positive

impact that mixed housing tenure could bring to a community to reduce the risk of low cohesion.

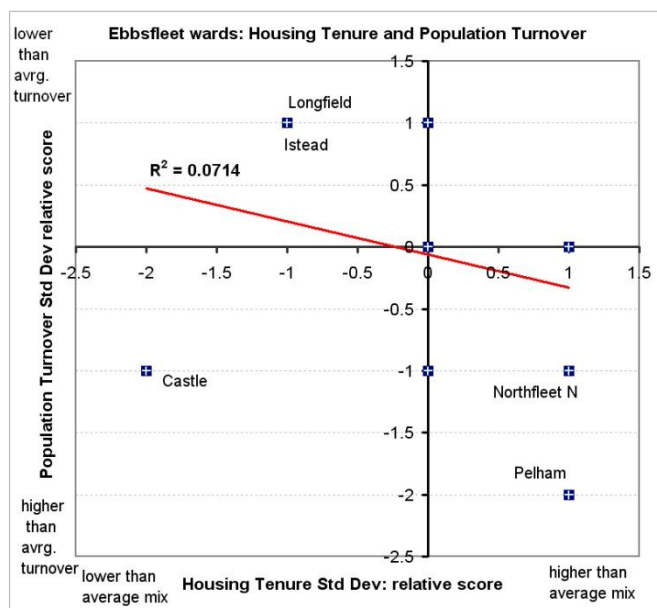


Fig. 8.51: Ebbsfleet 3km zone wards: scattergraph plot housing tenure vs. population turnover
(only peripheral wards are labelled)

The final input variable for the social cohesion score is collected at council borough level, which the Ebbsfleet analysis zone straddles two (see fig. 8.52 below).

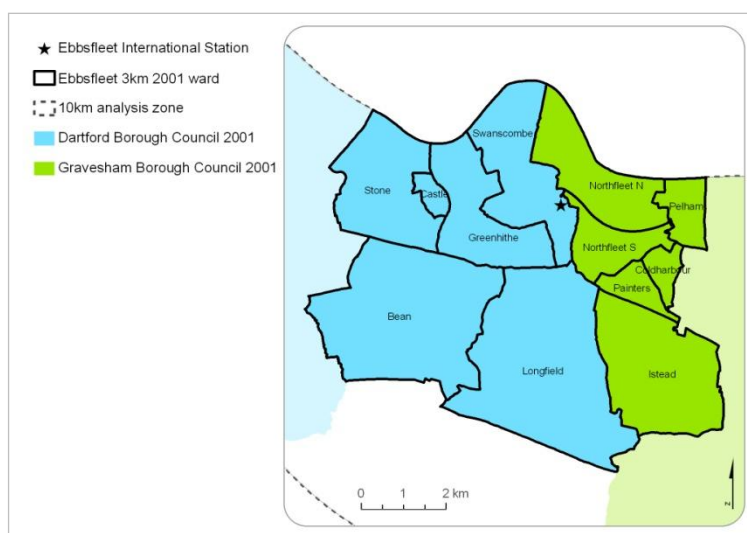


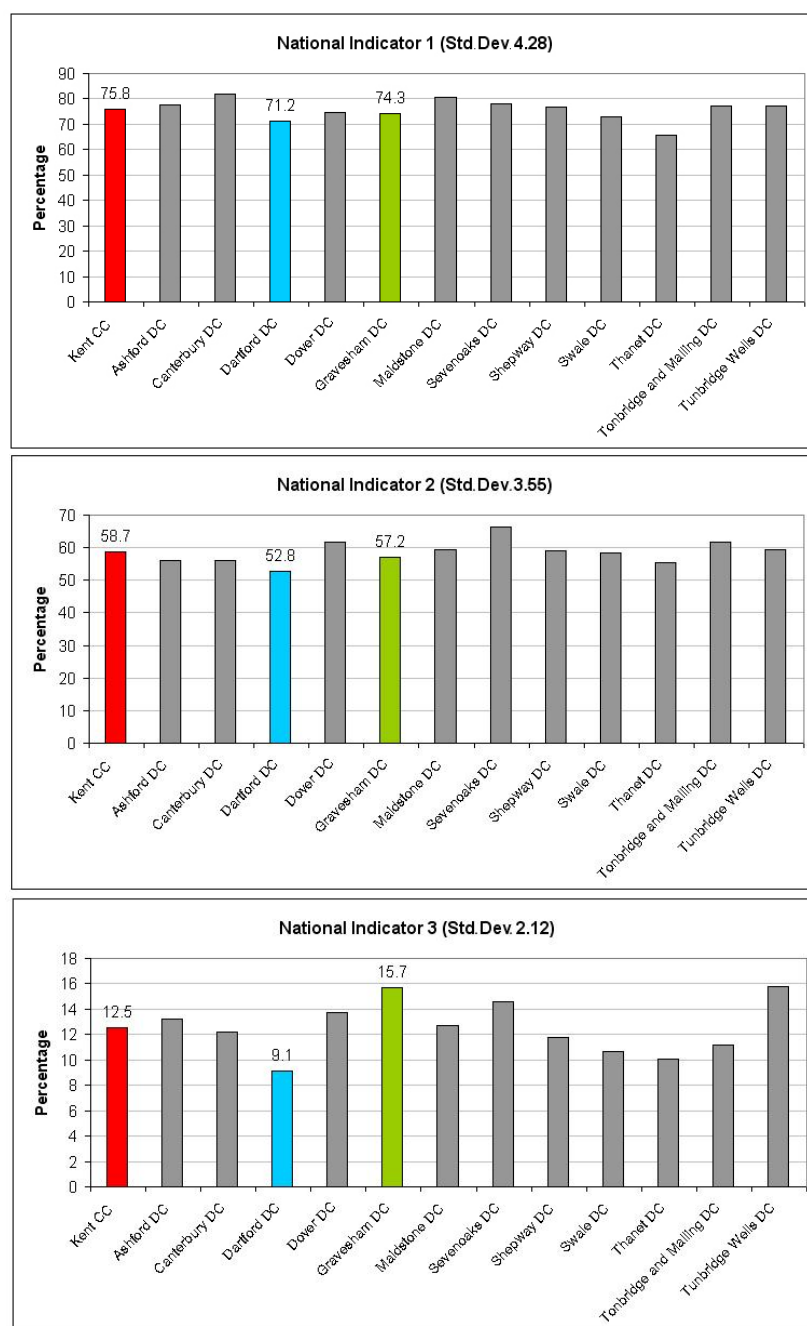
Fig. 8.52: The division of the Ebbsfleet wards into the higher 2001 borough council boundary definitions [©Crown copyright 2003 / UK Borders]

The National Indicator Set 2008, published by the Audit Commission, provides the following percentages to five indicators with strong influences upon perception of community cohesion:

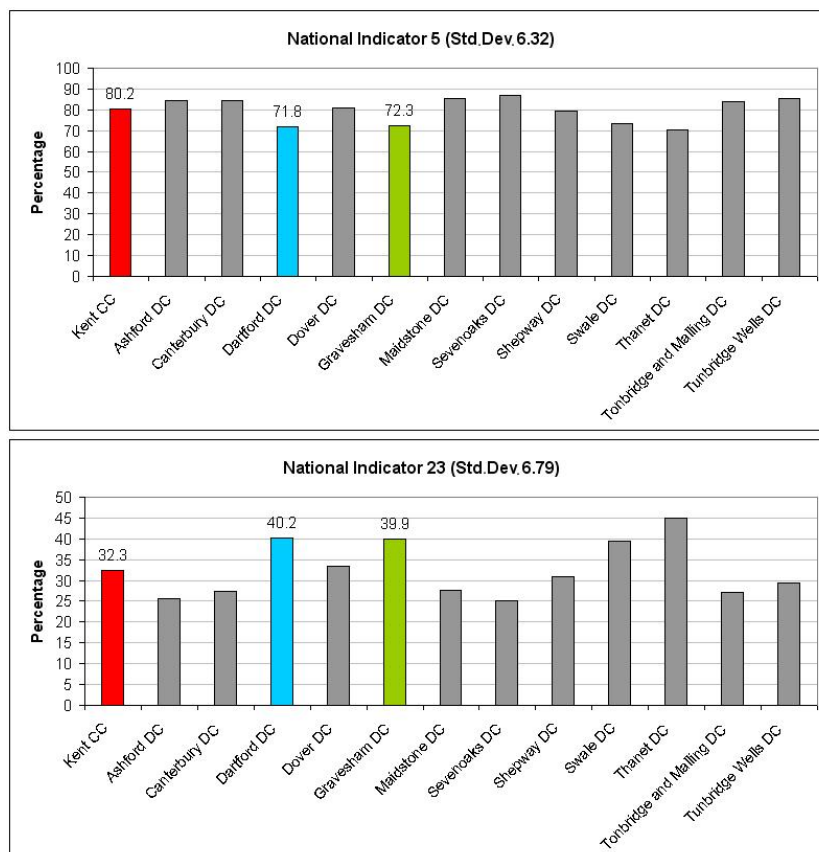
This is the proportion of the adult population who say they 'tend to agree', or definitely agree' that:

- NI 1 - their local area is a place where people from different backgrounds get on well together
- NI 2 - they feel that they belong to their neighbourhood
- NI 3 - they take part in civic participation in the local area
- NI 5 - they feel overall/general satisfaction with the local area
- NI 23 - they perceive that people in the area treat one another with respect and consideration

The data for Kent district councils was selected, the mean for Kent calculated (figs. 8.53-8.57) and the standard deviation value ranges that Dartford and Gravesham borough council fell within produced a relative cohesion score (see the calculations in appendix 10.23).



Figs. 8.53-8.55: National Indicators for Community Cohesion for Kent



Figs. 8.56 & 8.57: (continued) National Indicators for Community Cohesion for Kent

It would seem that Gravesham is considered relatively more cohesive than Dartford from these indicators. Dartford scored significantly below average (between -2.5 and -1.5 Std. Dev. see appendix 10.23 for calculations) for two indicators; NI 2 and 3 that have an emphasis on belonging to your neighbourhood. Gravesham Borough scored relatively well for two indicators, NI 3 and along with Dartford, NI 23 returns a positive value. The latter relates to treating one another with respect, and viewing the bar chart above for this NI (fig. 8.57), only Thanet borough council scores better than Dartford and Gravesham.

The Community Cohesion Score

In this case study, no ward in Ebbsfleet is at risk of Neighbourhood Division (i.e. an OAC demographic group separated by the CTRL line haul). Only one ward, Northfleet South, is relatively more exposed to potential inter-community tension following the construction of a new development alongside a traditionally blue collar residential area (the Community Segregation sub-indicator). Therefore there is very little 'added value/cost' – in this case disbenefits – where the MUTP could exacerbate wards that are at higher potential risk of low community cohesion (fig. 8.58 below).

Ebbsfleet 3km zone COHESION			DEMO- GRAPHIC PROFILES	HOUSING TENURE	CRIME	QUALITY OF LIFE National Indicators StdDev					MIGRATION	Impact SCORE	PHYSICAL BARRIER		With MUTP added score	Difference
Ward Name	Ward Code	Deprived Order				Mean per 10000	NI 1	NI 2	NI 3	NI 5	NI 23		Neighbourhood division	Community segregation		
Northfleet N	29UGDD	1	0	1	-1	-1	0	0	1	-1	1	0	0	0	0	0
Pelham	29UGGG	2	1	1	-2	0	0	0	1	-1	1	-1	0	0	-1	0
Coldharbour	29UGFY	3	0	1	1	1	0	0	1	-1	1	3	0	0	3	0
Swanscombe	29UDGP	4	0	1	0	0	-1	-2	-2	-1	1	-4	0	0	-4	0
Northfleet S	29UGGE	5	-1	0	0	0	0	0	1	-1	1	0	0	-1	-1	-1
Stone	29UDGM	6	-1	1	-2	-1	-1	-2	-2	-1	1	-7	0	0	-7	0
Bean	29UDGA	7	0	0	0	0	-1	-2	-2	-1	1	-4	0	0	-4	0
Painters	29UGGF	8	-1	0	1	1	0	0	1	-1	1	2	0	0	2	0
Greenhithe	29UDGD	9	-1	0	0	0	-1	-2	-2	-1	1	-7	0	0	-7	0
Castle	29UDGC	10	3	-2	1	1	-1	-2	-2	-1	1	-4	0	0	-4	0
Istead	29UGGA	11	1	-1	1	1	0	0	1	-1	1	3	0	0	3	0
Longfield	29UDGU	12	1	-1	0	0	-1	-2	-2	-1	1	-4	0	0	-4	0

Fig. 8.58: Community Cohesion in Ebbsfleet- MUTP value added scores. Unweighted

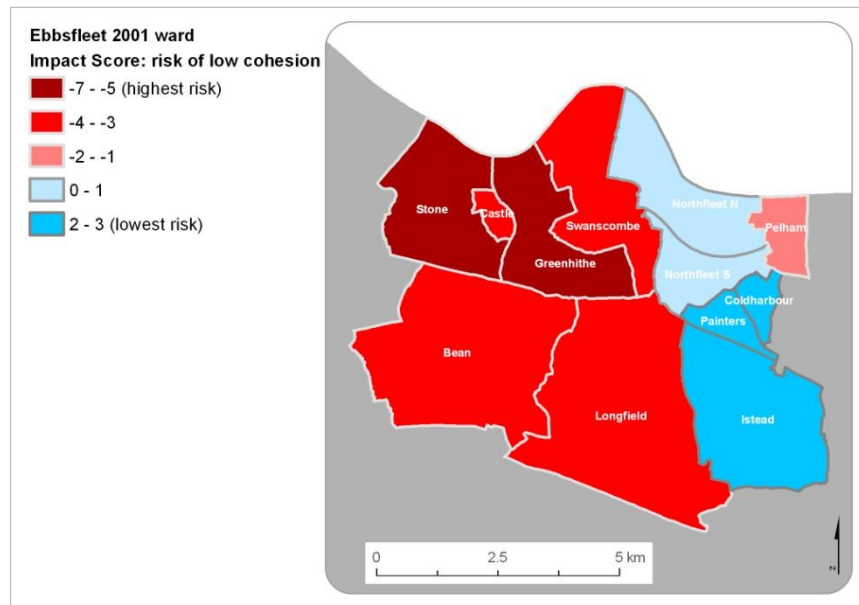


Fig. 8.59: Ebbsfleet 3km analysis zone: wards at risk of relatively low community cohesion [©Crown copyright 2003 / UK Borders]

Mapping the basic unweighted scores in fig. 8.58, suggests that the areas most at risk, relative to the scores for all wards, are concentrated in the north-west areas of the analysis zone (fig. 8.59). Only the size of Castle ward and its resultant overall positive diversity score (low intra-ward demographic diversity and therefore positive diversity value, but offset by a low tenure diversity score) reduces its overall risk of low cohesion score. All the wards in Gravesham (to the east) are less at risk due to the relatively favourable perception of their borough council through the National Indicator Set responses, aside from Pelham that has a high crime and population turnover. The ward with the lowest risk of low cohesion is Coldharbour, with average demographic diversity, high tenure diversity, lower than average crime rates, average or better than average responses to the National Indicator Set questionnaires and an average population turnover. In contrast Stone ward is at highest risk of low cohesion scoring below average for all indicators except above average housing tenure mix and response to NI 23 questionnaire (for Dartford Borough).

Greenhithe and Longfield wards are also at higher risk, and are relatively low deprivation areas yet the potential effect (in principle) of low tenure diversity, below average responses to most National Indicator questionnaires (and an above average population turnover for Greenhithe) leads to a result of risk of low cohesion. However the low density of population in Longfield ward, which is predominantly rural, may well offset this risk, although the effect of population density is not explored here.

In this case study, there is very little impact from the MUDP-related indicators included although the long-term impacts of regeneration following the delivery of the CTRL may well have effects upon the 'non-MUDP' inputs over time.

The Social Exclusion sub-indicator

All maps for this indicator are generated at LSOA-level, although the input data is either at OA or LSOA level, and all variables are aggregated up to ward level for the Social Exclusion sub-indicator, for cross-indicator set consistency. The first new map is the IMD Income Domain rank scores for 2007, transformed into standard deviations of the mean for the whole 10km analysis zone:

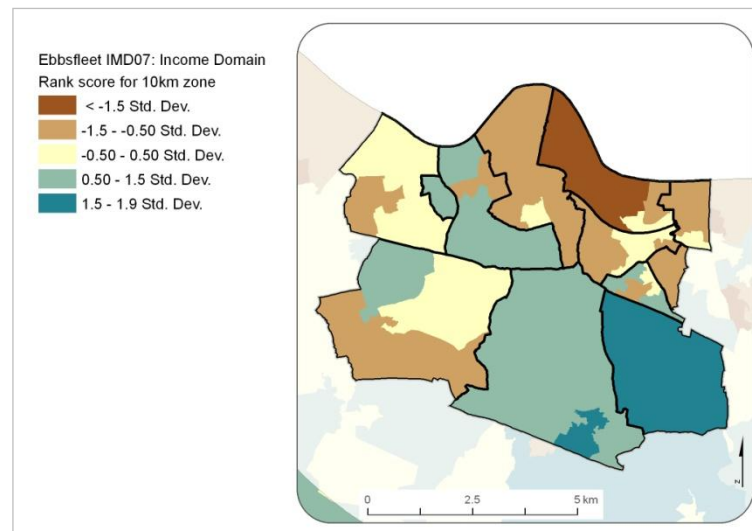


Fig. 8.60: IMD 2007: Income Domain rank scores displayed as standard deviations from Ebbsfleet 10km mean
[©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

These standard deviation values from the mean for Ebbsfleet 10km analysis zone are then altered, ranging from +2 (for LSOAs >1.5 Std. Dev. relatively low income-related deprivation) to -2 (LSOAs <-1.5 Std. Dev. relatively high income-related deprivation) (fig. 8.60). The sum for the ward is then taken for a final variable score (see appendix 10.24 for a breakdown of calculations).

Finally, as described within the methodology above (section 8.2a), this meta theme adopts two variables from the Employment Indicators of the 2008 Core Accessibility Indicators (D.f.T. 2009b) the first at LSOA-level; the percentage of those of working age (16-65) that are claiming Job Seekers Allowance (JSA), a proxy for unemployment levels.

Spatially, the highest levels, 5-6%, are mainly concentrated along the north-eastern part of the 3km analysis zone (fig. 8.61 below), the south-east having the least proportional unemployment whilst the westerly wards have quite a mixture of proportions. Data from fig. 8.61 (below) are transformed to standard deviations of the 10km mean (fig. 8.62). Wards are assigned a value from -3 (>2.5 Std. Dev. above the mean, very high unemployment levels), to 1 for <-0.5 Std. Dev. just below the mean). Full calculations are in appendix 10.25.

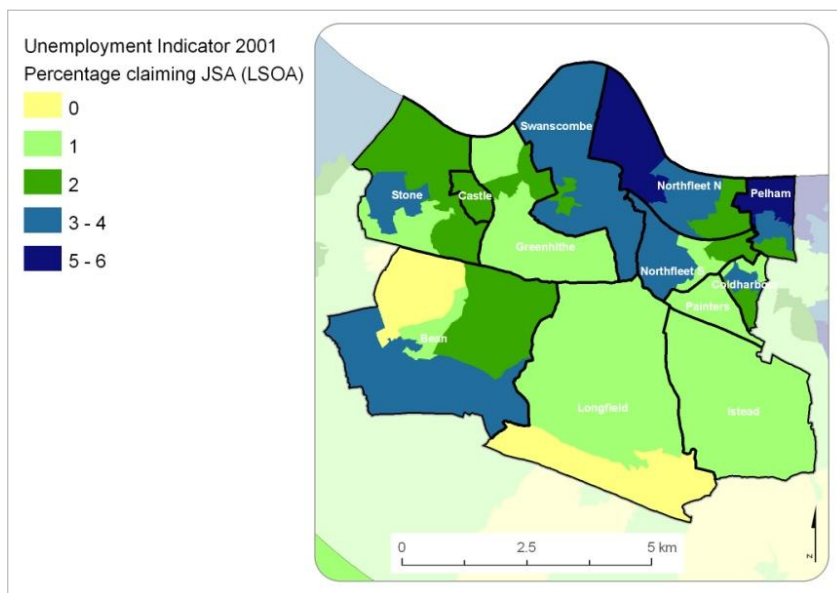


Fig. 8.61: Ebbsfleet Wards, percentage of those of working age claiming Jobseekers Allowance at LSOA level [D.f.T. Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

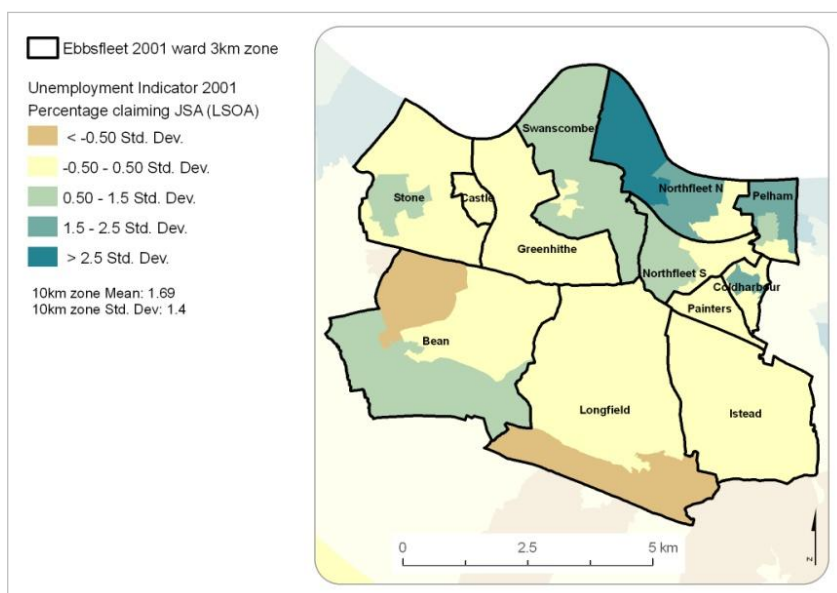


Fig. 8.62: Ebbsfleet Wards, percentage of those claiming Jobseekers Allowance at to 2001 Ward level. [©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

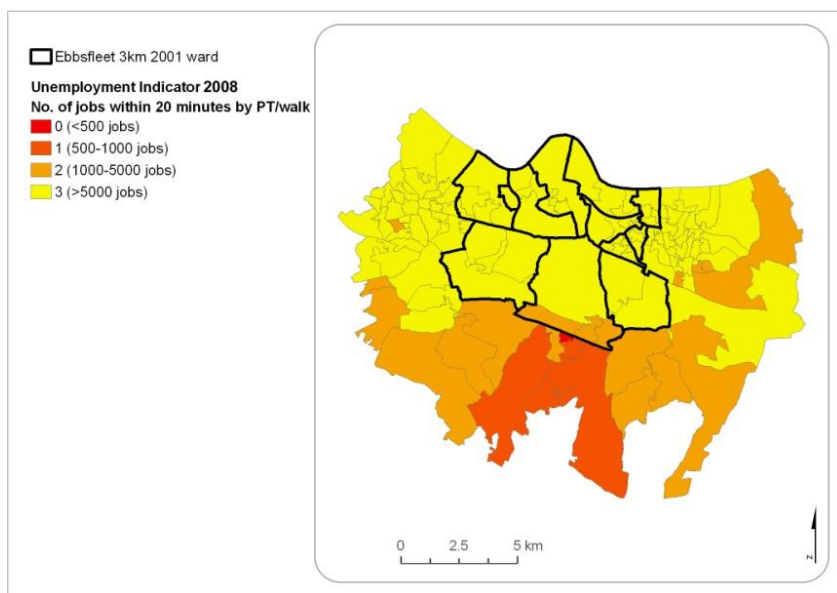


Fig. 8.63: LSOA level number of accessible jobs via public transport or walking in under 20mins [D.f.T. Open Government Licence v3 (data.gov.uk) & ©Crown copyright/database right 2011 Ordnance Survey/EDINA UK Borders]

The last 'new' indicator input is related to accessibility from the National Indicator Set NI 175. This provides a scoring for each LSOA according to the number of available jobs reachable by either public transport (the entire network) or walking in under 20 minutes (fig. 8.63 above). In Ebbsfleet, all LSOAs (bar three in the south of Longfield ward) are in band 3, the highest accessibility rating, with over 5,000 jobs reachable in less than 20 minutes. Interestingly the three aforementioned wards with the relatively lower accessibility in band 2, are three of four LSOAs with zero Jobseekers Allowance (JSA) claimants (see fig. 8.61 above). Therefore one cannot presume a lower accessibility is a straightforward link to greater risk of social exclusion through unemployment. Each ward is assigned the mean score of the LSOAs within it, therefore every ward is allocated a maximum value of three, except Longfield, which receives a lower mean of 2.2.

The 'added value / cost' from the MUTP delivery is the accessibility impact indicator from the feeder bus service Fastrack, and the Physical Barrier indicator regarding Impeded Access to local facilities (as a result of the line haul). The IMD Income Domain (standard deviation from 10km mean) scores are included. The Income Domain rank change between 2004 and 2007 are also incorporated so as to illustrate which wards both relatively highly deprived (income related) and are also falling in ranks and becoming relatively more deprived over time, potentially suffering from 'entrenched' income-related deprivation.

The Social Exclusion Score

Ebbsfleet 3km zone EXCLUSION Indicator			DEPRIVATION		UNEMPLOYMENT		Impact SCORE	ACCESS- IBILITY	PHYSICAL BARRIER	With MUTP added score	Difference
Ward Name	Ward Code	Deprived Order	IMD07 Income Std. Dev	IMD Income rank change	% on JSA Std. Dev.	jobs P/T <20mins		Fastrack	Impede Access		
Northfleet N	29UGGD	1	-5	-3	-5	3	-10	3	0	-7	3
Pelham	29UGGG	2	-3	-1	-5	3	-6	5	0	-1	5
Coldharbour	29UGFY	3	-3	-3	-2	3	-5	0	0	-5	0
Swanscombe	29UDGP	4	-3	1	-3	3	-2	3.5	-1	0.5	2.5
Northfleet S	29UGGE	5	-2	-3	-1	3	-3	0	-1	-4	-1
Stone	29UDGM	6	-2	1	-1	3	1	0	0	1	0
Bean	29UDGA	7	0	5	0	3	8	0	0	8	0
Painters	29UGGF	8	1	-1	0	3	3	0	-1	2	-1
Greenhithe	29UDGD	9	1	3	0	3	7	3.5	0	10.5	3.5
Castle	29UDGC	10	1	0	0	3	4	6	0	10	6
Istead	29UGGA	11	4	0	0	3	7	0	-1	6	-1
Longfield	29UDGJ	12	5	3	3	2.2	13.2	0	-1	12.2	-1

Fig. 8.64: Social Exclusion in Ebbsfleet and MUTP value added scores.

Four wards score negatively indicating potential risk of social exclusion to the population is present in a third of the 3km analysis zone wards (fig. 8.64). Despite the positive impact of the MUTP regarding the feeder service, Northfleet North's population are still relatively more at risk of social exclusion (fig. 8.65). Positive accessibility measures have reduced the risk of social exclusion for Pelham and Swanscombe wards, whilst Coldharbour ward has no MUTP-related impact, and some of the population of this ward are potentially at risk of social

exclusion irrespective of the MUDP. Northfleet South has moderate negative scores for entrenched deprivation (below average score and a negative rank change), a relatively high level of JSA claimants, no accessibility increase from the feeder and contains dwellings that have potentially had their access to local facilities impeded by the line haul. Other wards with no feeder benefits and theoretical impeded access have populations that are typically much less at risk of social cohesion, for example Painters and Istead wards. The ward with the lowest risk of social exclusion, Longfield, is not relatively income-related deprived, rose in income-related deprivation rankings between 2004 and 2007, below average JSA claimants and has a high proportion of job opportunities accessible by public transport, and has dwellings that may benefit from Fastrack.

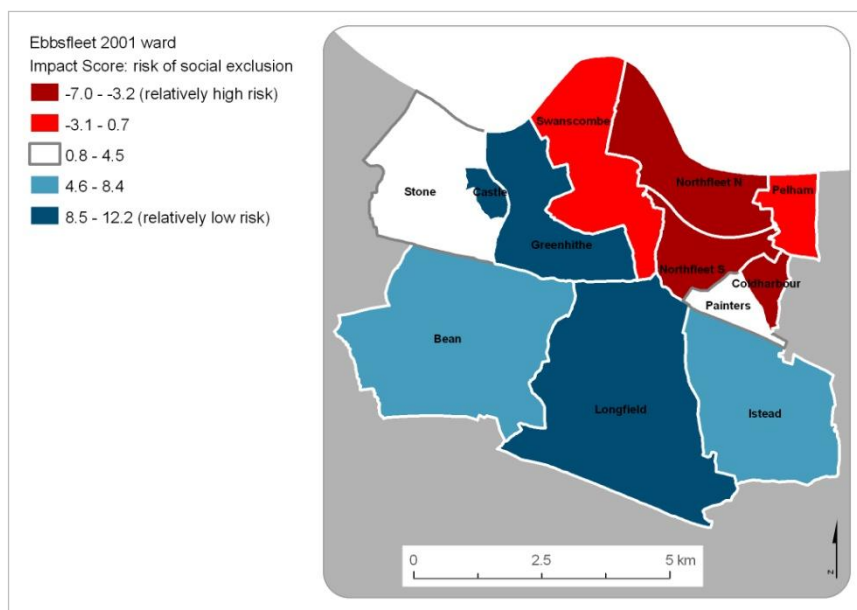


Fig. 8.65: Ebbsfleet 3km analysis zone: wards at risk of relatively high social exclusion

Northfleet North, Northfleet South and Coldharbour score the lowest of all wards, clustered around the north-east of the CTRL station at the edge of Gravesend. Painters ward is in close proximity but due to an above average income deprivation score, average JSA claimants and a high accessibility measure from Fastrack this ward has a lower relative risk.

As one may expect, the least deprived wards in the southern portion of the analysis zone, despite having no accessibility improvement from the Fastrack BRT route, are least at relative risk nonetheless.

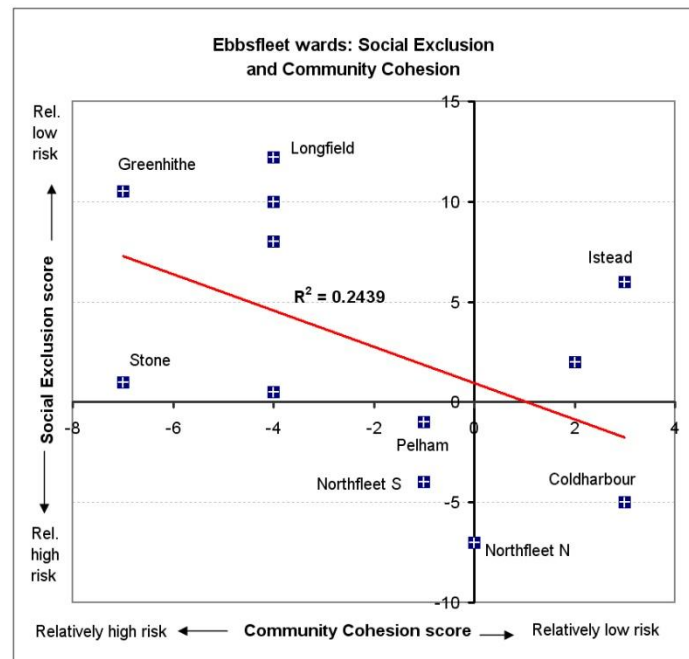


Fig. 8.66: Scattergraph plotting community cohesion and social exclusion for Ebbsfleet wards

This scattergraph (fig. 8.66 with the wards at the extremities of the values labelled) indicates the population characteristics that suggest they are at risk of social exclusion and/or community cohesion. Any wards that are located in the lower left-hand corner (unlike the decision-makers response matrix above fig.8.22) suggest that some of the population are potentially at risk of both low community cohesion *and* high social exclusion. Northfleet South and Pelham wards, with the suggested input variables, fall into this area. Northfleet South also falls into the potential overall negative outcome in the MUTP Combined Score above (8.1). Coldharbour, at high risk of low cohesion, is a very low risk for social exclusion, and vice versa for Greenhithe. The R^2 coefficient confirms that there is little correlation between these meta themes, supporting the notion that being at risk of one will not necessarily lead to an increased risk of the other, from the input analysis performed here.

The approaches here are an attempt to 'sense-make' the complex and complicated processes at work over the long time frames of the MUTP delivery. It is clear that the aggregation of the data up to ward-level certainly hides interesting and pertinent dynamics, which would be possible to assess in future applications of the method once Enumeration Districts are obsolete in regards to appraising and evaluating MUTPs.

8.2c

The Meta Theme indicator:

Findings

The meta theme indicators aim

This indicator aimed to help planners explore if and where there are relative risks of low community cohesion and/or high social exclusion within Ebbsfleet, and whether the MUTP, and its associated developments and infrastructure changes that potential risk.

The Community Cohesion indicator

It is a well known issue, as discussed in the literature review (chapter 2.2) that community cohesion is accepted to be a positive social state but difficult to assess and quantify. Given the limited spatially defined inputs viable to plug into the GIS, this is an attempt to examine how the MUTP can improve areas in Ebbsfleet at risk of low cohesion, or at the very least, minimise negative impacts that exacerbate the problem.

The approach to score the non-MUTP variables (Indices of Diversity: demographic and tenure mix, crime statistics, National Indicator sets and population turnover data) followed by the cost or benefit 'added value' the MUTP contributes is helpful (fig. 8.58) in theory. In practice, the Ebbsfleet case study sample yields no perceivable relatively direct MUTP cost/benefit value, other than a small negative score for possible issues related to absence of community segregation in a single ward (Northfleet South). Given the negative connotations inherent in the Neighbourhood Division and Community Segregation measures, a null value in almost all wards is a reasonable aim for local planners. There is a notable conceptual tension between increasing inter-community segregation when faced with a large influx of demographically different residents, and the potential benefits of population diversity and improved access to local facilities and services.

Regarding the conflicting or ambiguous nature of the Indices of Diversity (for demographic and tenure mix), the scoring of the variables by their standard deviations from context specific means results in many wards with a combined neutral score of zero, or no change following the inclusion of the tenure mix from assessment of the demographic mix alone. The exceptions are Northfleet North, Swanscombe, Coldharbour and especially Pelham who all score neutral or slightly positively for relatively little demographic diversity, but have an above average mix of tenure. At the other end of the scale, Castle ward with essentially no demographic mix (at Output Area Classification level) also has very little tenure diversity (nearly 90% outright ownership or mortgaged homes). Therefore this ward has a slight increase in risk for low cohesion than by considering demographic mix alone. Careful

consideration would be needed as to how to measure and incorporate 'diversity' when exploring cohesion in future applications of this meta theme indicator, especially given the low correlation between tenure mix and population turnover. The wards with the lower than average mix, had lower than average turnover, hence the ward scale of analysis could be obscuring patterns that are occurring at much more localised, perhaps at OA level. As noted in the data input section above, stronger push/pull factors for migration may also be overriding this suggested relationship between tenure and turnover. Local planners may be better positioned to grasp the nuances of these dynamics and able to assess the relative impact of the MUTP.

The National Indicator Set (and their successors) lack intra-analysis zone distinction, so currently only provide a very general assessment of a relatively large geographical area. Instead, a locally defined survey published at LOSA-level regarding residents' perception of community cohesion would be the input of greatest help given how subjective community cohesion is. Requesting an answer to the (seemingly) straightforward question 'Do you feel you belong to this local community – if yes: how, if no: why not?' would provide some basic parameters to comprehending local views of what makes a community a 'community', given the spatial structure of the urban population and their demographic. If they respond with answers that include the MUTP under study, this would be very helpful in gaining an understanding of how prominently the project impacts upon local people (note the caveats of respondents' demographic, e.g. Dittmann and Goebel 2010).

For Community Cohesion, the current approach shows promise in achieving the aim, and this brief current assessment suggests that the MUTP delivery did not cause further negative impacts relating to increasing the risk of low community cohesion. Wards that were at relative risk to others, and some variables that contributed towards this were identified. Addressing these low cohesion factors within the regeneration of the area along with the MUTP would be a positive element to be incorporated into the project appraisal.

Future datasets that could be of help regarding this meta theme include an assessment of the workplace flows for each of the wards within the analysis zone. The assessment carried out in the preceding indicators suggested that there was significant (at $p < 0.05$) difference between the distances travelled by those living in the least and most deprived wards. Differences may emerge to indicate if there was a risk of areas of the hub becoming a 'dormitory' community, with long distance commuting leading to an early-out and late-back population, leaving the neighbourhood relatively deserted. Sub-ward level in/out internal migration origin-destination statistics may also provide a clearer pattern of where and when people are moving in and out of the hubs, particularly in association with the related developments.

Finally, transforming all the input variables from means to standard deviations of a sample area mean resulted in a coherent approach to quantifying the data, although a basic ranking from high to low values would have similarly provided an output that describes the relative risk between the Ebbsfleet wards.

The Social Exclusion indicator

Social Exclusion as a result of joblessness is a potential risk to the population in areas where there is continued deprivation, low accessibility to employment, and the journey to work is not improved by MUDP related transport changes for those most deprived. This latter meta theme indicator works better in theory at exploring the risk of exclusion at the hub with higher spatial resolution of data, more input (both positive and negative) with the MUDP, and good integration into Kent's Local Transport Plan 2006-2011. Some wards, previously ranked as an area where some of the population were potentially 'at risk' of unemployment-related social exclusion, are within the Fastrack 400m bus stop buffers and hence are able (if it is affordable to travel on it) to access greater numbers of local employment opportunities. These wards therefore benefit hypothetically from the MUDP, although some also potentially experience a reduction in access to local services due to the line haul.

Exploration of the many alternative variables within the Core Accessibility Indicators Employment variables (D.f.T. 2009b) may reveal one or a combination of measures from this source elucidate the issues that increase the risk of unemployment-related exclusion. For example, utilising the indicators that focus upon 'at risk' populations (in this example those claiming Jobseekers Allowance) such as 'the percentage of risk population weighted by the access to employment centres by public transport or walking' could yield some more refined outputs. Similarly building up a profile of changes over time by utilising subsequent yearly releases of these data will strengthen any patterns that may emerge.

Regarding the real-world interpretation of the indicator outcome, social exclusion is a phenomenon experienced at a very fine scale, individual-level, even related to the time of day. Therefore this exercise is very coarse, and even at OA level could over-simplify the extent to which some people experience social exclusion. Bearing this in mind, the smallest spatial scale is required for future applications of the methodology, and its limitations borne in mind by planners seeking to reduce unemployment-related exclusion.

Future Guidelines for decision-makers and planners

The final scattergraph that plots social exclusion against community cohesion finds, as one would expect (given the difference in input dataset and alternative dimensions of social problems) that overall there is only a very minor correlation ($R^2 = 0.24$ see fig. 8.66). The identification of the wards with populations at risk of either relatively low cohesion in their community or being socially excluded, and those that fare the worse in the overall Combined

Scores (discussed above in section 8.1) such as Northfleet South and Coldharbour wards, is helpful to decision-makers. Understanding the dynamics of the wards that are positioned around the periphery of the scattergraph provides a basic profile of how an area may be at low or high risk of these meta themes, and provide planners an opportunity to improve many aspects of these areas possibly utilising the MUDP as a catalyst of social equity.

Lessons-learnt for decision-makers and planners

Learning from the examples of wards that appear from this study to exhibit low exclusion or high cohesion enables MUDP decision-makers and planners to extract those traits and consider how and where best to improve the situation for those at the other end of the spectrum. Although the output from these two indicators is highly context specific, the inputs are from generic sources and can be adapted to re-run the methodology in a different geographical or spatial context. Cohesion is a 'complex' process whereby the residents' opinions such as the responses given in the National Indicator Set questionnaires, are hard to anticipate given their highly subjective perspectives. Also the ambiguous effect of diverse demographic types and house tenure is hard to artificially engineer for a large urban area with an established community. The impact of different levels of diversity can mean a more or less cohesive community to different people. However, reducing the effects of any fragmentation of the community and considering the (negative) social impacts of promoting longer distance commuting away from the hub via the MUDP along with intervention to reduce crime rates may see a fall in high population turnover which could lead to a more positive cohesive community of both existing and new residents.

Measures to reduce unemployment-related social exclusion include encouraging the growth of a network of affordable public transport options such as the MUDP feeder BRT, as well as the potential of job creation that an MUDP-related development often offers. Whilst the Ebbsfleet Valley development may or may not come to pass, the Fastrack feeder seems to have decreased the potential for high social exclusion to the 'at risk' population in several wards such as Northfleet North, Pelham and Swanscombe.

It would seem that the meta themes require further local knowledge than the Combined Score, as a result of the personal, subjective perspective these social phenomenon manifest in the population. Given the prominence in government policy, there are no widely employed frameworks currently to quantify these issues within current MUDP appraisal criteria, possibly due to their localised complex outcomes. Yet these maps and associated outputs are a move forward to quantify elusive 'distributive effects' that may give decision-makers pause for thought when planning the finer local details for an MUDP.

This meta theme indicator closes the chapter for the creation of the indicator set along with indicator-specific findings. Within chapter 8, the strengths and pitfalls of drawing together

multiple input datasets to create a more comprehensive aggregate assessment are explored. The Combined Score created a foundation for understanding which wards were more at risk of overall negative outcomes from the MUDP, which allows planners to consider how to manage and mitigate in the future. The Community Cohesion and Social Exclusion indicators proposed to illustrate the extent to which an MUDP can affect 'at risk' populations, although the subjective nature of these makes it hard to draw any firm conclusions at these scales of resolution.

The final chapter below draws conclusions regarding the overarching aims, objectives and research questions, and considers the future viability of such an approach in the field of transport planning, appraisals and evaluations.

9.

Conclusions

Within this chapter, there are discussions relating to the overall methodology, rather than individual indicators. How well the approach responded to the research aims, objectives, and the research questions are examined, and potential future applications and limitations of a GIS-based assessment are considered. These close the chapter and the thesis.

Response to the research aims and objectives

The research aim

Although many of the individual approaches within the thesis are not original nor of the greatest technical sophistication, the assimilation of all of these data and techniques together as a indicator set to permit the exploration of social impacts of MUTPs for non-users (not included in current appraisal frameworks until April 2011) as presented here is novel.

The aim stipulated at the start of this research, was as follows:

I aim to be able to derive generic and context-specific impact indicators following the creation of easy to understand and communicate maps and charts within a GIS environment. These will supplement tools such as Planning Support Systems currently available to policy-makers, planners and urban developers. A synthesis of this indicator set's output will provide a broader understanding of changes so as to play a role in the planning, appraisal and evaluation of MUTPs. This new knowledge can go towards forming guidelines and lessons-learnt for future MUTPs.

In response to this aim, seventeen datasets were processed as sub-indicators and explored both individually and/or collectively in a combined indicator set or a meta theme (community cohesion and social exclusion). The maps were carefully considered to produce a clear message whereby the units were meaningful and the potential for ambiguity or confusion was reduced. All of the variables themselves were relatively generic (i.e. freely available from open sources), although the parameters were context-specific. Cross-project comparisons would be viable, although not necessarily of use as the indicators have complicated and sometimes unrepeatable influences upon one another, seen in the difference in outcomes between Ashford and Ebbsfleet. External, non-quantified pressures as well as the unique spatial and demographic configuration of the hubs mean that each holistic application of the indicator set is viable for that time period and space. However, generic and context-specific lessons learnt and future guidelines for planners and decision-makers as discussed in each indicator findings section are useful for feeding into new applications of good planning practice for MUTPs. Any examples that can be held up as a successful example of local and regional transport planning with positive 'distributive effects'

for future MUP appraisal frameworks will be a constructive step to reversing the low-priority interest that currently exists regarding these issues.

Achieving the research objectives

In attempting to achieve the objectives, technical issues and conceptual realities inevitably re-orientated the focus to a more manageable scope than that which was planned at the outset. However the objectives remain the same so as to clarify the strengths and limitations of this approach.

1. To identify and derive impact indicators from datasets across different contexts.

Carrying out an assessment of the CTRL's hypothetical impact was not going to be holistic given the incomplete nature of this MUP, and whilst the domestic service came 'on stream' during the course of the data collection phase of this research, clearly data capture generally preceded it. However, as the indicator set is aimed at use by local planners (and subsequently decision-makers in a higher stratum of government) before, during and after the MUP, an demonstration of the methodology was carried out by creating a single time period social profile of the hubs, around the time of the MUP delivery. Identifying key datasets that contributed towards a rounded exploration of impacts considered 'social' and experienced by the 'non-user' (in the sense that it was not directly linked to the patronage of the MUP) was carried out by assessment of data repositories. These included the ONS, Digimap, CIDER, WICID and the government (Department for Transport, Local Government and Communities, Kent County Council) for example. Future spatial coherence between boundary definitions and the conceptual methodology behind the creation of Output Area (OA) and Super OA level data will improve this method greatly for future evaluations of the CTRL hubs, and comparisons with potential hubs along the HS2 alignment, currently in consultation stage.

The demographic profiles from the 2011 census-based OAC will be a rich source of information if the spatial scope of the analysis is rooted in a meaningful, context specific definition (such as pseudo-boundaries for neighbourhoods). The coarse, generic approach taken here is a useful starting point to illustrate how and to what extent diversity (demographic and tenure) changes is a positive force, where low-key community segregation may be a positive intervention, and where low community cohesion is a potential risk.

Further consideration of areas at risk of 'entrenched' deprivation with the release of the IMD 2010 dataset will confirm any tentative patterns apparent in the comparison between 2004 and 2007 IMDs. No doubt the reduction of relative and absolute deprivation of all dimensions is one aim of bringing an MUP to an area (especially if regeneration is touted as a benefit from the project outset). Therefore this will continue to be a significant indicator, although its

place as an MUTP impact is least proven due to the plethora of deprivation-reducing policies in place in a region at any one time.

The feeder bus services (actual and planned) represent a measurable change in relative accessibility for the population around the MUTP stations, both as a mode to access the MUTP for users, and greater accessibility to both job opportunities, and community facilities and services in the locale for non-users (universal affordability was not assessed in these cases). The accessibility measures were context specific, such as exploring the demographic profiles or levels of deprivation of the potential customers for example. However, the approaches to the map outputs and examination of the measures are adaptable to other contexts. The Transport Needs Index method for Ashford was more straightforward to operationalise and communicate than the classic 'potential gravity-based' measure carried out for Ebbsfleet, although it is anticipated that the approach chosen for the latter is reasonably intuitive. Accessibility changes could take place with further local transport infrastructure changes that occur with a new MTUP such as an altered road network layout, new cycle paths or an improved pedestrian environment, although these are not explored in this case study. Feasibility or traffic modelling exercises are likely to have taken place by local transport planners as part of the current planning and appraisal programme of the MUTP.

The suite of sub-indicators within the 'Physical Barriers' indicator were the most subjective and difficult to quantify, yet it is these kinds of significant changes that potentially impact positively and negatively on the social lives of people who live in proximity to an MUTP for which there was a relatively limited value within the appraisal process.

The final main indicator, Journey to Work, explored where and how people travelled to work providing key information on what and where to exploit the potential financial investment of the MUTP so as to promote more sustainable travel patterns in and around the hubs. No post-project delivery datasets were available at the time of data analysis. Nevertheless, as the sustainability agenda becomes ever more important, data of higher spatial and temporal resolution could become available to judge the success (or areas of weakness) regarding MUTP-related transport changes around the hubs.

2. To clarify if 'context is everything' or what generic lessons for decision makers can be identified.

From the perspective of this GIS-based mapping exercise it would be pertinent to assume that context is highly important for defining the scope of the areal units, analysis boundary definitions, time-frame and inclusion of some or all of the indicators. However, reflecting upon the *Cynefin* framework (chapter 6), the processes within the 'known' and 'knowable' domains inherently suggest that there is a relatively understandable cause and effect

relationship between the MUTP delivery and the social changes at the hubs. These can range from 'being expected in advance', to 'understandable in hindsight'. This suggests that there are sometimes generic processes at play, and planners and decision-makers can formulate good practice guidelines from the lessons learnt as described by the indicator-specific aims and objectives. These can feed into planners' theoretical comprehension of the social impacts of an MUTP. Context defines the real-world planning practice (extrapolated from generic good practice from previous experiences), and this needs to be tailored to prioritise where the most negative / least positive impacted areas are located around the MUTP.

Examples of lessons that could be gathered from such an analysis include:

- Understanding the level of correlation between deprivation and overall negative outcomes of the MUTP
- Capturing the extent to which MUTP-feeder services can improve accessibility for both potential users of the MUTP, and serve those with the highest public transport needs
- Whether MUTP-related local transport changes could facilitate the step-change in travel behaviour needed to reduce car usage across the urban hubs
- Clarify and assess how and if MUTPs can potentially reduce the risk of low community cohesion and high social exclusion

Higher spatial and temporal resolution datasets will refine the lessons learnt as locational and attributive ambiguity is decreased. However, there will often never be any final confirmation of the MUTP impact, as unexpected complex processes will shape the hubs socio-demographically, economically and physically. In this case, this indicator set aims to aid regional/national decision-makers to promote the positive potential social benefits that an MUTP can bring to an area for both direct and indirect intentional impacts within the appraisal framework. It can also prepare local planners for identifying areas at potential risk of negative effects, both direct and unintentional.

3. To contribute to the Omega Centre's question 'What constitutes a successful MUTP?' by discussion of the impacts, costs and benefits potentially derived from assessment of the case-studies, with particular reference to non-user impacts.

One of an MUTP planner's roles is to balance positive outcomes for the MUTP at a local, regional and national level whilst limiting the negatives. Within this research it is evident that social impacts for non-users are not generally at the forefront of the criteria for measuring the success of an MUTP. As expected the CTRL does appear to cause a mix of negative and positive outcomes across the hubs that may be deemed significant in future appraisals of MUTPs.

Potential social costs that the indicator set aims to draw attention to included increasing relative spatial confinement following the construction of the infrastructure which in turn exacerbates entrenched deprivation and high crime rates. Decreased accessibility due to the

infrastructure to local facilities by walking resulting in longer, sometimes car dependent journeys, and decreasing community cohesion perceived by the residents due to high population turnover and greater demographic diversity must occur in a relatively short space of time.

Possible MUTP related social benefits include wider regeneration benefits provided they are experienced by all of the population at the hubs and not restricted to more affluent incoming residents. This could lead to lower population turnover, less deprivation, and more social and financial optimism in the area. Improved accessibility through affordable feeder services and improved local transport initiatives, and well-placed points to traverse the MUTP such as bridges and underpasses to allow relatively unimpeded walking and cycling. Subtle design of social space between old and new development residents, possibly using the MUTP as a segregational barrier can be construed as beneficial if there is a risk of tension, although new developments can bring with them more shops, schools, clinics and recreational facilities that could be out of physical reach for the old communities if the segregation/integration of space is not sufficiently flexible.

Hence, beyond the wider political and financial goals for a mega project, in terms of non-user social impacts, an MUTP may be judged regarding its 'success' if there is improved social equity⁵ at the hubs following the delivery of the MUTP. This includes positive management and intervention planned for areas that are at relatively high risk of the disbenefits associated with the delivery. At a higher conceptual level, success could be evaluated with respect to the system depicted in chapter 6; the Seven Samurai approach. The efficiency of the system process, the communication and cooperation between the inter-linking dynamic relationships of the system's agents and the resultant state of the 'modified core context' (as measured by this indicator set) could form a loose framework within which to judge the success of the MUTP delivery and its on-going impacts.

4. To discern what are the strengths and weaknesses in using GIS as a tool to reach the above objectives.

The aim of a GIS-based indicator set is to communicate issues to a wide range of people including members of the impacted community, potentially of use regarding the current Localism Agenda for bottom-up planning participation. For an appreciation of the fact that comprehending map-based data is not a universal ability, intuitive and clear maps are essential. The (ArcMap) GIS user community generate and release bolt-on tools, which continue to enhance and refine the software to collate, manipulate and display data with. The

⁵ Social equity is defined here as increased equal opportunities to access resources and participate in community life in a safe and healthy environment.

(Reliable Prosperity www.reliableprosperity.net/social_equity.htm [Accessed June 2009])

functions of this indicator set are viable to be automated, with some consideration to the availability and licensing of some data such as that from the Ordnance Survey.

To summarise in light of the creation of the indicator set:

Some strengths of a GIS-based approach:

- Mapping these impacts enforces the notion that these are spatially-linked effects and the potential (dis)benefits that the MUPT can bring to a small localised area is quickly assimilated
- Power to manipulate large datasets and accurately extract sub-datasets of interest
- Overlaying different data to assess the potential influence one may have either upon another, or collaboratively (for example spatial confinement polygons and deprivation rankings, or population turnover and housing tenure)
- Visualisation enhanced by vector drawing tools (colour ramps, hierarchies of map layers), are very easily changed to suit needs. This includes adjusting the output to greyscale so as to enable relatively low-tech re-distribution (such as photocopying) and the communicability of the map remains coherent.

Some weaknesses of a GIS-based approach:

- Technical knowledge is needed to manipulate the hypothetical indicator set
- The cost of the software represents a significant investment
- Graphs (bar charts, radar charts, scattergraph plots etc) within the GIS environment currently lack the attributive data necessary to extract the full potential of these data output (and were often produced in MS Excel for this study)
- It is difficult to represent uncertainty with a plain vector map as used here, although fuzzy set theory mapping is possible. This approach removes the necessity to assign a variable to either a positive or negative class, and transition between membership and non-membership is not abrupt but gradual. This is inherently useful where MUTP impacts and preceding processes are sometimes highly complex (Openshaw and Openshaw 1997, Smithson 2006).

Such technology could offer much from enriching decision-making and the delivery of policy initiatives, elucidating complex and complicated socio-environmental processes. Furthermore the indicator set could provide a framework for evaluating the possible effects of different decisions (working with an understanding of attribution and complexity issues), improving dialogue and engagement with MUTP and community stakeholders (Diez and McIntosh 2009, 2010).

Responding to the main research questions

The initial research question considered the utility of a GIS to identify MUTP impacts and the subtleties of context:

Q.1 “Can a GIS-based social impact indicator approach enhance the planning, appraisal and evaluation process for MUTPs despite the diversity and complexity of project contexts?”

In establishing the framework for responding to this, a distinction was drawn between first order impacts and second order impacts. The ‘first order’ types were the outcome of direct changes; costs or benefits to the natural or built environment and population caused by the project itself. ‘Second order’ impacts are indirect changes costs or benefits to the natural or

built environment and population, specifically socio-economic changes to the non-user population. Here the MUTP may be considered the most influential catalyst for the changes, i.e. outcomes attributable to a first order impact. These direct and indirect impacts can be interpreted as on a spectrum from intentional (quasi-)planned outcomes, or unplanned complex outcomes to unintentional and chaotic outcomes. Depending upon where they are on this spectrum, decision-makers should expect to be able to either amplify benefits from the positive outcomes or dampen and mitigate their negative effects as necessary. Adding the social impacts for the non-users of the hubs is an important, undervalued dimension to the current planning and appraisal process of an MUTP. Being able to capture and explore an initial group of potential changes occurring at the hubs is hopefully sufficient to bring these considerations from relative local obscurity to the attention of regional or national decision-makers. The GIS-based indicator set presented within this research undoubtedly has strengths and weaknesses regarding the planning process, but in conjunction with the *Cynefin* interpretive framework has the capability to enrich planners involved with MUTP delivery. Without the *Cynefin* model, the GIS indicator maps provide a basic albeit wide-ranging illustration of social aspects of the hubs, clarifying issues that the planners may already be aware of. With the introduction of the *Cynefin* model, these issues are considered through several decision-making lenses, allowing the indicator set to function as an impact management framework.

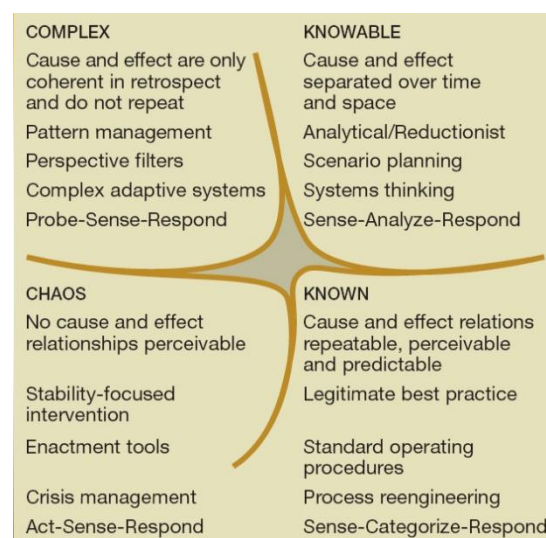


Fig. 9.1: The *Cynefin* framework with four response domains (Kurtz and Snowden 2003)

Planning is to foresee and manage the 'known' or 'knowable' social outcomes for the non-users, and anticipate complex processes and their potential outcomes. The findings sections of each of the impact indicators suggest a possible management strategy for the potential impact and its short to long-term implications. The *Cynefin* framework (fig. 9.1) is however, a sense-making model rather than a categorisation structure, and therefore the impacts need to be carefully considered before planners and decision-makers choose a course of action with which to respond.

The indicators that fall within the 'known' process domain of the *Cynefin* framework (see fig. 9.1 above) include the accessibility measures and the potential increase in job opportunities. Here planners can identify households that can access the bus routes, and the accessibility measure will clarify the potential impact for those households. The Linear Barrier sub-indicators for Impeded Access to local facilities are similarly 'known' if the measure is conducted at a suitable resolution, finer than the example carried out above. Accurate understanding of the impediment the new line haul brings to people regarding access to their nearest shop or GP for example can be considered. The *Cynefin* framework recommends that the most appropriate action for managing these impacts is 'Sense-Categorise-Respond' to the data inherent in the GIS output, hence the cause and effect is as repeatable and relatively linear as one could consider when dealing with social processes. Improvements or extensions to the feeder bus routes, and passes over or under the line haul would have relatively predictable outcomes, due to data collection and analysis from other similar projects.

The 'knowable' or complicated indicators include Multiple Deprivation Index rankings and associated sub-domain of Geographical Barriers, as well as Journey to Work; both the workplace flows and modes used sub-indicators. Here planners and decision-makers can 'Sense-Analyse-Respond' when managing these impacts or processes since the effect of the action are delayed, sometimes over an unknowable amount of time. Scenario-planning by experts with detailed knowledge is useful in this context and the GIS toolkits can provide the general underlying pattern over time where deprivation is high and a low ranking position does not improve, or where the associated transport changes are not encouraging people away from car use and on to buses or walking / cycling. Increases or decreases in the population at risk of social exclusion, and areas associated with low inter-community segregation can also be classed as 'knowable', as they have close links to deprivation, unemployment and demographic profiles. Experimentation regarding the adoption of good practice may be an appropriate response to the GIS output datasets (such as trying new bus or cycling incentives, or creating informal differentiation of social space to ease any possible inter-community tension) when capitalising upon the regeneration effect cascading through the local community. The MUTP, here the CTRL service, brings new investment and population to the hub, and a continuous cycle of data gathering and analysing is necessary to ascertain the pattern of cause and effect.

The 'complex' domain of the decision-making process is populated by several of the toolkit input datasets including the Population Turnover and Index of Demographic Diversity; both of which consider the changing population profile of the hubs and their unknowable (in advance) impact on the existing community both in the short and long term, but is retrospectively coherent. The Linear Barrier sub-indicator variables Neighbourhood Division and Relative Spatial Confinement as well as the Combined Score (overall 'favourable' to

'adverse' impact) and the meta themes of Community Cohesion are considered 'complex' social processes. The MUTP's impact upon these is nebulous, closely associated with personal perception of ones' own environment and circumstances. 'Probe-Sense-Respond' is a recommended management strategy, experimentation to either amplify the positive impacts or dampen if negative (although precise details are unpredictable). This category of process are difficult to learn lessons from for decision-makers, as they are often an outcome of an unknowable variety of inputs, the configuration often unique to that context and usually unrepeatable in other contexts. Nonetheless, monitoring and ongoing assessment are possible, and preparation for reducing negative impacts as planners sense them is desirable.

As stipulated in the interpretive framework (chapter 6), the GIS toolkit cannot provide support for processes and impacts that occur in the 'chaotic' domain; financial crises and natural disasters for example are beyond its remit, although planners have other tools to hand to consider these in tandem.

Given the complexity of the multi-layered planning framework in the U.K. for transport projects, clarity of the potential social issues and a base outline of an impact management would be advantageous when promoting a scheme to MUTP decision-makers (whose primary concerns may be political and financial) and affected community members.

MUTP planning:

The adoption of nationalised datasets (such as the IMD and the census) provides a common base for the indicators but local spatial definitions will have to be generated by planners responsible of the community around the MUTP. The level of technical competence with GIS will vary depending upon the planning unit, but generally we can presume that such an exercise is carried out on behalf of, or in partnership with, a planning department by a consultancy. Once the preliminary profiles have been created (such as the profiles created within this research for Ebbsfleet and Ashford), identifying areas that are already at risk of relatively adverse (few benefits and/or many negative effects) outcomes from the MUTP should be possible before the construction commences. However other impacts (especially those in the knowable and complex domains) will only be partially understood, even in the long-term.

Pre-project planning should therefore include all the primary indicator datasets as presented here, to create a baseline for as much socio-economic data at a workable resolution (for example OA and LSOA for a 3km analysis zone is viable). The indicator set can provide a basis for the spatial configuration of the demographic profiles and diversity of the hubs, and base data regarding the deprivation of all dimensions over time. Modelling the potential outcomes of accessibility (with either or both methods demonstrated above) is accomplishable if the feeder bus routes and stop locations are decided. The toolkit could

identify where populations with high public transport needs and where long distance commuters - as potential users of the MUTP - are situated. Further contextual knowledge is required however to clarify how neighbourhoods can be defined, and catchments areas for essential services and facilities and their current access routes (especially by foot and cycling).

MUTP appraisals

Following the decision to construct the MUTP in principle, the appraisal process currently does not place a high value upon these potential impacts compared with economic and political pressures. However, as described within each indicator methodology section, MUTP benefits that are viable to consider within the appraisal process include the reduction of multi-dimensional deprivation, better accessibility and lower car usage through local transport changes. Also the reduction of social exclusion and improved community cohesion could be planned as part of the project's regeneration programme. The details of how these can be achieved can be demonstrated by the indicator set maps to all stakeholders including community members during project consultations, as hard-copy or interactive, online maps.

In the appraisal process, NATA now does cover some aspects of non-user distributive effects, albeit different in many cases to those presented in this thesis. Some recent observations (for example Banister and Thurstain-Goodwin 2011, Wolmar 2011) imply that the business case for rail compared to road schemes is insecure without the consideration of distributive effects. Therefore positive social impacts, if well considered and implemented, along with an intelligent approach to negative impacts could provide substantial added value to a project in an appraisal exercise.

MUTP Evaluation

Post-MUTP implementation and long term monitoring for adjustment, experimentation and lessons-learnt of the transport project and its associated development impacts is highly beneficial to community members and planners. In the past this has rarely been carried out, and not within a standardised framework to enable cross-comparison and to elicit guidelines. Moving beyond the traditional (and inadequate) measure such as whether the project was on time, on budget and to specifications (e.g. Ogunlana and Toor 2010). Strategies for managing impacts as per the *Cynefin* model can lead to lessons-learnt and future guidelines, some more context specific than others. Yet, the impact assessment needs to be holistic, not merely encompassing construction and management criteria even if attribution to the MUTP is uncertain.

A write-up of which variables can be considered non-user MUTP-related physical, economic and social impacts from the case-study produces a list that includes:

Physical

- Line haul related linear barriers (neighbourhood severance and impeded local access)
- Urban redevelopment: construction of new residential areas and new facilities (shops, schools, healthcare)
- Local transport infrastructure changes (new road layouts, pedestrianisation, cycle paths, bus priority lanes for better MUDP access)

Economic

- Multiple deprivation changes both positive and negative
- Employment (accessibility improvements)
- Relocation of businesses to the local area
- House price changes (positive and negative)

Social

- Demographic diversity (occurring at a range of spatial scales)
- Population churn (in and out migration)
- Community cohesion (quality of social life)
- Social exclusion and polarisation

This is clearly not an exhaustive inventory but one would imagine that the above are expected changes at the CTRL hubs, although the extent that they can be attributed to MUDP alone is usually never known. Environmental impacts are discounted from this study as 'Environmental Impact Assessments' are presently carried out for all transport appraisals including the CTRL.

Most of the above listed variables are examined to some degree in the indicator set through the lens of socio-economic related changes. MUDPs can include new or upgraded/extended high-speed rail, metro, motorway, bridge or tunnels and the siting of these in relation to the wider urban (or rural context) will determine if, by how much, and at what scale the above variables occur around the MUDP (see Flyvbjerg et al. 2003 and Gospodini et al. 2005 for examples). For example a bridge such as the Rion-Antirion Bridge, crossing the gulf of Corinth in Greece was the catalyst for local regeneration plans as well as an attempt to fulfil regional transport link, travel time savings and pollution reduction targets (Taylor 2011b). The Cross-City Tunnel, Sydney, Australia considers local-area regeneration, travel time savings, accessibility improvements and reduction in air pollution to be some of its core objectives (Taylor 2011c). In both of these cases, and others detailed within the OMEGA Centre project profiles [www.omegacentre.bartlett.ucl.ac.uk/studies/cases] the social impacts listed above are not explicitly stipulated in early MUDP objectives or outcomes, as known by the Centre's research although these are potential benefits that may come to be realised in the future. Were these un-quantified and undervalued by the project's stakeholders in the initial project promotion of the MUDP?

It would seem that the GIS cannot draw out socio-economic patterns that are *exclusively* the impact of the MUDP. This is largely because so many impacts and their extent are unknowable due to the complex nature of socio-economic processes in general. This does

not detract from assessing changes that potentially could or have occurred around the MUTP, and supports the need for such a GIS indicator set with localised amendments and improvements. Physical infrastructure would notionally have 'known' effects, with the most straightforward cause-effect relationship. Therefore the MUTP impact outcomes listed under 'physical' are relatively repeatable not only for high-speed rail projects but other MUTPs, such as metro, motorway, or tunnel etc. Economic outcomes are more complicated although they can be modelled to some extent (by hedonic house price models, regional economic development strategies, for example) and are on the cusp between known and knowable outcome domains. Social impacts are those that are least repeatable or generic. Broad definitions and basic targets such as establishing demographic diversity (at various scales), community cohesion, and relative confinement are a useful start in the planning and appraisal of the MUTP, in association with the formal appraisal methods discussed in the literature review (chapter 3). The outcomes of the case study scattergraph plots in appendix 10.17 and 10.19 suggest that any correlation between variables, such as deprivation versus other indicators, is not generic between contexts, and therefore cannot be expected to produce similar outcomes at a new hub.

Hence in response to the first research question, due to the number of impacts that most likely fall within the complex domain (due to their context-specific nature) suggests that the indicator set would function most successfully with local planning departments. They would be able to set the scoring and the impact indicator weights to levels that reflect local priorities, the results of which can be communicated to a wider audience from local community members to regional- or national-level decision-makers. The ability to set the simple scoring by local planners reflects the difficulty in quantifying some of these issues in the first place (particularly without an essential 'feel' for the dynamics of the community). The narrative accompanying the map outputs should include the words: 'relatively', 'potentially' and 'at risk' to qualify the indicators rather than stating any interpretation of spatial patterning as hard fact.

Decision-making relating to the socio-economic issues from MUTP impacts to non-users comprise of 'what', 'when', 'where' and 'why' to intervene. 'What' is mixture of generic standard or best practice enhanced by local contextual dynamics and the effects of which range from 'known' (anticipated) outcomes to 'complex' and 'unknown' (anywhere from intentional to unintentional long term). 'When' will be highly context specific, although parameters for understanding the effects of impacts will set a basic timeframe. 'Where' is answered by the GIS indicator set along with local planners' knowledge of the community population, transport infrastructure and land use patterns. All of these and the 'why' are ultimately politically and financially driven, and priority for 'what', 'when' and 'where' will depend on many opposing pressures.

It is important to note that the interpretation of the indicator set outcomes with use of the *Cynefin* framework is that of the author alone. As discussed previously, the *Cynefin* framework is a sense-making and decision-making model whereby the nature of the impact is unpacked first and then an appropriate domain is chosen from which a course of action can be implemented. However, the understanding the nature of the impact is very much a subjective exercise and will undoubtedly vary between local planning units, regional strategic planners or national decision-makers. The *Cynefin* model is not prescriptive, but instead is able to respond to the fluid and dynamic nature of social changes over time where flexibility is necessary for a successful management strategy. A range of stimuli or initiatives, MUTP-related or otherwise, may well move an impact outcome from one *Cynefin* domain to another.

Q.2 “Can GIS-based social impact indicators provide planners and decision-makers with a better understanding of the MUTP impact on community cohesion and/or social exclusion?”

The final aggregation of input variables for the cohesion sub-indicator considered demographic and housing tenure diversity, quality of life questionnaires, population turnover and crime levels. In addition to these variables, neighbourhood division and community segregation were the two pertinent MUTP-related variables included. Together these formed a pilot indicator set for considering the role MUTPs have in increasing or decreasing the risk of community cohesion. Regarding the research question, this indicator set proposes that MUTPs have a part to play in community cohesion and social exclusion, both positive and negative depending upon how and where they are implemented. Hence contextual dynamics play a large part in this question, making it difficult to answer for generic planning purposes. Fragmentation of an existing community in proximity of the line haul and/or associated infrastructure, and new and old communities of differing demographic profiles, potentially unhappy about sharing urban space are possible concerns that could arise, increasing the perception of low community cohesion in areas already at risk. However, from the data available for Ebbsfleet, the CTRL has had barely any influence in this regard thus far.

The accessibility and deprivation measures were both significant inputs into the Social Exclusion sub-indicator. There was no direct causal link established as yet between the MUTP delivery and changes in deprivation, either absolute or as increases/decreases in relative rank. The accessibility element was present in the employment input ‘number of jobs within 20 minutes walking or by public transport’, a sub-variable of National Indicator 176. The MUTP-related accessibility measure for the Fastrack B route was a ‘highlighted’ public transport mode, explicitly calculated and added to the aggregate score for social exclusion.

Practical applications and implications

SYSTEM ENVIRONMENT
Sustainable Development and
Regional Urban Planning

CORE CONTEXT

System 1: Current Appraisal and Evaluation Frameworks for Mega Urban Transport Projects in the UK

Problem 1: Limited understanding by decision-makers and lack of tools to assess social impacts for non-users of the MUTP at the transport hubs, such as increasing social exclusion and decreasing community cohesion

MODIFIED CORE CONTEXT

System 1a: Enriched planning procedures and more inclusive MUTP appraisal frameworks

Problem 2: Unanticipated outcomes due to lack of data availability and inconsistency through MUTP delivery timeframe

System 2: Intervention: Design of perceived social impacts framework changing with emerging sustainability agenda

System 3: Realisation: Adoption of complex adaptive systems approach and Cynefin framework as analytical model

System 4: Deployed: Dynamic GIS tools to explore potential and actual social impacts. Quantitative analyses

System 5: Collaboration: Non-GIS based data analysis and research

System 6: Sustainment: Increased training for decision-makers in use of GI tools and understanding of social impacts for non-users at MUTP hubs

System 7: Competition: Other, non-specialised Planning Support Systems & Decision Support Systems

System 8: Feedback: Lessons-learned and future guidelines

Contextual Framework 1

Contextual Framework 2

Contextual Framework 3

Primary PhD output

Long-term tertiary PhD result?

Secondary PhD output aim

needs to understand both S1 and P1

intended to address (preventing something undesirable)

may solve

competes for resources with

may cause

collaborates with

sustains

becomes (intended to be the same)

needs to understand

may need to develop or modify

becomes

Fig.9.2: The Seven Samurai of Systems Engineering: the research context and contribution to the field

As a reiteration of the research scope, this final section reviews the processes, relationships and outcomes of the study. This situates it within the current planning, appraisal and evaluation of MUTPs in England, and provides the framework for comprehending the contribution made to the field of transport planning, with reference to the Seven Samurai system in fig. 9.2 above.

The Core Context of the GIS indicator set is the current appraisal and evaluation frameworks for MUTPs in the UK; considered to be inadequate and over-simplistic to grasp the full impact of the project, particularly long-term. This led to the research problem: a perceived limited understanding by decision-makers and lack of tools to assess the social impacts (planned and unintentional) for non-users of the MUTP at the transport hubs. Distributive effects are acknowledged to exist by decision-makers but rarely assessed, and there was no standardised framework to explore them.

System two is the theoretical solution to this problem. This entailed the design of a social impacts framework, the creation of 17 sub-indicators and a methodology for interpreting spatial patterning and the management of outcomes; positive, neutral and negative. The knowledge management system was the adoption of a complex adaptive systems approach and more specifically the *Cynefin* framework. This acts as analytical model to 'sense-make' the social impact indicator datasets created over time for the evaluation of the MUTP's social impact at the hubs.

The deployed system (system 4) is the final design of a GIS indicator set to explore potential and actual social impacts. Five main indicators: Demographic Profiles, Deprivation, Accessibility, Physical Barriers and Journey to Work together provide a starting point to explore MUTP-related changes at the hubs. Two further indicators pertaining to Community Cohesion and Social Exclusion are piloted with some success, to consider if and how an MUTP can improve these social phenomena. However, there were unanticipated outcomes due to a lack of data availability and inconsistency through the MUTP delivery timeframe. This was most acutely noted due to the spatial and temporal resolution of the chosen datasets, whereby the coarseness of the scales used undoubtedly clouded what were already complex and subjective outcomes further. However some patterns were explored and the approach holds promise for future applications given the increasingly fine spatial resolution and greater sophistication regarding the creation and publication of digital information. A further unanticipated outcome was the reticence of the target user-group to embrace an IT-based solution for exploring social impacts. GIS technology was absent at both the local and regional levels of planning and decision-making relating to this case-study. Interaction and feedback from the potential user-community was absent and therefore the findings and conclusion lack an essential element of 'ground-truthing' that would have been highly beneficial.

Non-GIS based tools, datasets and approaches are potential sources of collaboration with the output of the indicator set (system 5). Besides the 2010 IMD and 2011 Census / OAC outputs, further datasets that could provide interesting perspectives to the current study include Space Syntax Depthmaps to explore the permeability of the hubs before and after the MUDP delivery. This could provide an assessment of the impact of the physical infrastructure itself regarding fragmenting neighbourhoods, reducing access to local facilities and services and increasing spatial confinement. Also improved local transport changes particularly cycling and walking around the community (not solely for accessing the station for example) may be detectable.

A further element of methodological collaboration could be the collection and use of enhanced datasets, namely primary datasets collected on behalf of the planning unit. Information regarding context-specific elements of the changes undergone within the hub such as relating to particular transport infrastructure initiatives, or regarding new aspects of redevelopment or questionnaires to gauge community cohesion levels. However, this was not carried out for this study for two reasons that remain pertinent if the methodology is viable in a real-world context. Primarily, the use of secondary data is related to resource costs - both financial and time - for this study and a local planning department in terms of data collection and processing. Furthermore, the use of primary datasets would make cross-comparisons with other MUDPs in England less straightforward and the methodology would have become much more context-specific. This would have gone against the premise of the thesis; to enhance the planning, appraisal and evaluation procedures currently in place in England. However, if a private consultancy were to carry out this assessment, it could and should be repeated more often than every 10 years (with the current release cycle of English Census data), although some impacts are likely to be developing for decades. Therefore context-specific data collection exercises could be considered necessary in order to appraise the potential impacts for aspects not covered sufficiently clearly by the secondary datasets and/or to evaluate the MUDP impacts effectively short and long-term. This would increase the cost of the assessment and decrease the cross-project comparability, but these pitfalls would need to be weighed against the increased clarity of the social profile of the hub by planners and decision-makers.

The creators of the *Cynefin* framework, *Cognitive Edge*, produced a software package entitled SenseMaker in order to facilitate serendipitous unbiased links to be made between data to enrich decision-making strategies [www.sensemaker-suite.com]. The Omega Centre embarked upon an exercise to elicit narratives and revealing anecdotes from key stakeholders via 'pre-hypothesis' questionnaires regarding the planning and delivery of the CTRL. From this (and accompanied by 'SenseMaking Items' such as newspaper clippings and photographs) the data were indexed and tagged, and incorporated into the SenseMaker

suite. The report regarding this approach is due towards the end of 2011. Creating a link between quantified data as currently assessed in the indicator set, and unanticipated influences and impacts brought about by relatively obscure decisions made, leadership and stakeholders dynamics or the element of trust and risk could be highly informative. Lessons-learned from a combination of generic and highly context specific qualitative data would be greatly enriched. A brief outline of the CTRL questionnaire for the pre-hypothesis data gathering exercise is located in appendix 10.26.

Finally the modified core context (system 1a) following the delivery a GIS impact indicator set such as this to planners and decision-makers, leads to an enriched planning procedures and more inclusive (multi-criteria) appraisal and evaluation frameworks for MUTPs. Distributive effects are considered, their benefits and potential negative impacts explored and management strategies based on the *Cynefin* model considered, so as to provide improved social equity to the non-users at the hubs. The sustainment of this context requires there to be increased training for planners and decision-makers in the use the *Cynefin* framework to identify and manage non-user social impacts, and in the greater use of GI tools to explore the spatial patterning of the effects. The 'competition' to the GIS indicator set are other, non-specialised Planning Support Systems and Decision-Making Support Systems. Government departments at local regional and national levels do engage with software to various extents. These explore, for example, accessibility impacts (i.e. D.F.T.'s 'Accession'), multi-scalar deprivation mapping of the IMD by Kent County Council, and the Local Planning Portal used by Gravesham Borough Council to name a few. However no system provides an indicator set expressly to assess the potential social impacts of a mega urban transport project within a community.

A review of the Seven Samurai approach was useful to make explicit the contribution to the field of transport planning, appraisals and evaluation - both practical and theoretical - and any shortcomings of this research. The social impacts of MUTPs are considered in an *ad hoc* manner often in the later stages of the appraisal, if at all. This is due to the current bias of economic and political motivations behind the delivery of the project and the lack of standardised framework within which to consider these often complex and context-specific issues. The GIS-based indicators provide a means to explore repeatedly over time the social profile of the transport hub with seventeen input datasets relating to different social issues that could be addressed with the delivery of the MUTP. The secondary datasets used from national data repositories ensures that the framework is valid for different geographical contexts, as are the current appraisal and evaluation processes. Cost issues relating to the collection and use of primary data are discussed above, and are potential enhancements to the approach, which were not viable to develop for this study. The introduction of the *Cynefin* interpretive model to the GIS indicator outputs is a novel theoretical approach to managing these impacts. Comprehending the implementation and delivery of an MUTP as a complex

open system with fluid and dynamic processes ought to allow planners and decision-makers to anticipate and mould the outcomes so as to maximise social equity of the hub communities. Such a decision-making strategy framework has not been used in transport planning previously, but has highly relevant approaches to the planning, appraisal and evaluation of an MUTP. These were clarified in the findings of individual indicators helping to define the lessons-learned and future guidelines for planners and decision-makers for other MUTPs.

Consultation for High-Speed 2 is currently underway, which could utilise such a hypothetical indicator set to consider the impacts at Birmingham, Manchester and Edinburgh. The Hybrid Bill for the controversial £17bn high-speed rail link is timetabled for approval in 2015, construction is planned to start around 2017 and operations to begin around 2026. Thus far, the feasibility study and business case for the route have been submitted to government and consultation is underway. [www.hs2.org.uk]. Within the documentation of the socio-economic sustainability appraisal of the HS2 service, key elements are the journey time savings, employment forecasts, development and economic impacts around the interchanges (Booz and Temple 2011). Social impacts for the non-users have not been incorporated explicitly within these appraisal reports. No doubt they are implicitly understood to occur along with the proposed levels of residential and commercial regeneration and local transport changes. However, these are commonly couched in economic benefit terms, such as increased office floor space and the movement of the potential labour force. Vociferous anti-project campaigners have engaged with the government citing a lack of business case, unreliable economic forecasts and poor environmental assessments [www.stophs2.org]. The planning permission for HS2 is anticipated to be via a Hybrid Bill (see chapter 3 for more details regarding Hybrid Bills) as was the passing of the CTRL Act (1996) and Crossrail Act (2008), another railway MUTP. This will mean that all planning and other legislative requirements will be met at once, thereby bypassing much of the work usually carried out by local authorities for the planning of smaller-scale infrastructure works. Within the Bill there will be a Strategic Environmental Assessment, Environmental Impact Assessment(s), clarification of mitigation measures, identification of compensatory arrangements, and the considered consequences of these (House of Commons 2010). The details of the Bill, including a highly specified proposed route, will need to be debated and approved by both Houses and be subject to close scrutiny by a Transport Select Committee before being granted Royal Assent. The recent publication of the HS2 Select Committee Report (House of Commons 2011), lists the greatest concerns as follows:

- the lack of context and the absence of cohesive plans for transport strategy generally (and the rail network more specifically), mean that there can be no certainty that high-speed rail is the most pressing transport need facing the country
- the opportunity cost is high: other schemes offering better value for money will be passed over

- a new line is not needed: sufficient passenger capacity can be provided by lengthening trains and improving existing lines
- the economic case is flawed and the benefits are overstated
- the claims for economic regeneration and rebalancing are unfounded
- the new line will damage local environments and has little or no carbon reduction benefit
- the proposal to operate 18 trains per hour is technically unproven, and
- the proposal is rushed and alternative routes should be considered (ibid. section 13)

Of particular relevance to this study is the concern for economic (and thereby potentially social) regeneration not being realised. The cities of Lille and Frankfurt in mainland Europe were cited as positive examples of the economic and social regenerative effects of a high-speed rail link. Yet, transport experts who presented at the hearing remarked that there needed to be highly integrated economic planning, with broad local and regional accessibility initiatives for this to be even possible (ibid. Points 51-53). Furthermore, regarding the impact of HS2 to address north-south regional socio-economic imbalance, Professor Vickerman was quoted as saying that it was very difficult to predict the impacts of high-speed rail on individual cities, and that the results to date had been mixed (ibid. Point 52). Professor Tomaney was cited as remarking “the impacts of high-speed rail on local and regional development are ambiguous at best and negative at worst.” (ibid. Point 54).

Despite the breadth of concerns voiced regarding the construction of HS2 – both within parliament and beyond - the Hybrid Bill allows for relatively little petitioning by anti-project campaign groups, although individuals are able to if they are directly impacted by the scheme. More detailed engagement within consultations would have been possible if the MUP had been planned as a significant infrastructure scheme and managed via the Major Infrastructure Planning Unit (formally the Infrastructure Planning Commission). However, the Transport Select Committee report remarks that protest groups (e.g. StopHS2, 51m, AGHAST and the HS2 Action Alliance) deemed the consultation process to have been significantly flawed. They state that much of the information was inaccessible or not impartial, and that ministers were stating the decision had been made to proceed irrespective of negative evidence presented to them (ibid Points 84-85). This illustrates the feeling of malcontent by the local (possibly non-user) residents impacted, or potentially impacted, by an MUP, and continues to be a prevailing feature of MUP planning and delivery. The GIS indicator set provides one method to explicitly explore and discuss costs (and potential mitigations), and benefits that the MUP could bring to a hub even for those not choosing to use it. If utilised within the context of HS2, this indicator set would provide local planners, stakeholders and local campaign groups with a detailed understanding of the potential social benefits and costs of this new high-speed rail project. They could formulate a considered strategy for managing these foreseeable outcomes, prepare for the ‘known unknowns’, and become conceptually aware of the potential for ‘unknown unknowns’. Process transparency, a willingness to cooperate along with dialogue between all stakeholders would also hopefully reduce tension and resentment between communities and

the promoters of a project. However, given the paucity of GIS technology within current planning departments and local authorities, and the overriding economic and political interests in the cases made for MUTPs, adoption of this approach is unlikely to be straightforward in the immediate future.

People's lives could be changed for the better by the improvements a mega infrastructure project may make to their community; more optimism, better affordable accessibility, new facilities and services, and higher socio-economic aspirations. Planners and decision-makers of MUTPS currently do not, but ought to consider working towards these, which are as important as travel time savings or increased office space, to make the MUTP delivery and its long-term impacts a positive, inclusive local and regional experience.

Licence agreements, copyright ownership statements and disclaimers

Copyrighted material has been used with permission by end-user licence agreements from the respective bodies. Below are the copyright ownership statements and citation details applicable to all relevant datasets throughout the thesis. In order of inclusion in the thesis:

1. Census Unit Boundaries: UK Borders / EDINA

Edina (a JISC National Data Centre based at the University of Edinburgh) Digimap / UK Borders service: boundary data for Enumeration Districts, Output Areas, Lower Super Output Areas, Middle Super Output areas, South-East England and London boundary definitions and the Intergrated Transport Network.

©Crown Copyright/Database right 2007-2012. An Ordnance Survey/EDINA service [OS OpenData licence]

2001 Census: Digitised Boundary Data (England and Wales)

Data Service Provider: Census Geography Data Unit (UKBORDERS), EDINA (University of Edinburgh) and/or Census Dissemination Unit, Mimas (University of Manchester) and/or Centre for Interaction Data Estimation and Research (University of Leeds)

Service Funder: Economic and Social Research Council (with the support of the Joint Information Systems Committee)

Data Collection Funder: Ordnance Survey; Office for National Statistics

Original Data Creator: Ordnance Survey; Office for National Statistics

Depositor: Office for National Statistics

Registrar: Census Registration Service (University of Essex)

Copyright and source information

Crown copyright : Census output remains Crown copyright.

Copyright statement: The source of all 2001 Digitised Boundary Data must be acknowledged prominently using the words: "Source: 2001 Census, Output Area Boundaries. Crown copyright 2003."

Confidentiality Census output incorporates safeguards against possible identification of any particular person or household. The licensee shall not use the census output to attempt to obtain or derive information relating specifically to an identifiable individual or household, nor claim to have obtained or derived such information.

2. Census table datasets 1981 - 2001: ONS & CDU

The information on the Office for National Statistics (ONS) / Neighbourhood Statistics website is subject to the conditions of Crown copyright © unless otherwise indicated. Reproduction of information is subject to the terms of the Open Government Licence for public sector information and the UK Government Licensing Framework.

The Census Dissemination Unit (CDU) is a unit of the ESRC Census Programme, and is based within Mimas at The University of Manchester

3. Output Area Classification [a.k.a. The National Classification of Census Output Areas]

The classification is a joint project between the School of Geography, University of Leeds and the Office for National Statistics (ONS). The project was funded by the Economic and Social Research Council (ESRC) and the ONS.

4. CORINE landcover maps:

Rights: EEA standard re-use policy: unless otherwise indicated, re-use of content on the EEA website for commercial or non-commercial purposes is permitted free of charge, provided that

the source is acknowledged (<http://www.eea.europa.eu/legal/copyright>). Copyright holder: European Environment Agency.

5. Indices of Multiple Deprivation 2004 & 2007: ODPM and DCLG

Provided via data.gov.uk web portal and supplied through the Open Government License v3.0. The Neighbourhood Renewal Unit in the Office of the Deputy Prime Minister commissioned the Social Disadvantage Research Centre (SDRC) at the University of Oxford to produce the IMD 2004. The IMD 2007 was also constructed by the Social Disadvantage Research Centre (SDRC) at the Department of Social Policy and Social Work at the University of Oxford. The team comprised: Michael Noble, David McLennan, Kate Wilkinson, Adam Whitworth, Sonia Exley, and Helen Barnes. In addition, the Health Domain was constructed by Chris Dibben from the University of St Andrews; the 'air quality' indicator by Jon Fairburn at Staffordshire University; the 'housing affordability' indicator by Professor Glen Bramley at Heriot-Watt University; and GIS work was undertaken by SDRC's GIS consultant David Avenell. The population denominators were kindly provided by the Small Area Population Estimation Unit at the Office for National Statistics (ONS). All figures can only be reproduced if the source (Department of Communities and Local Government, Indices of Deprivation 2007) is fully acknowledged.

6. Carstairs Scores 1981-2001:

Generously provided by Dr Paul Norman of Leeds University, School of Geography. [email 5th June 2009 – attached]

7. MasterMap Address Layer 2:

Ordnance Survey ©Crown Copyright. All rights reserved. Maps reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.

8. Transport Needs Index: Steer Davies Gleave

Reproduced with kind permission of the author Tony Duckenfield [email February 2012]

9. 2001 Census: Special Workplace Statistics (England, Wales and Northern Ireland)

Data Service Provider: Centre for Interaction Data Estimation and Research (University of Leeds)

Service Funder: Economic and Social Research Council (with the support of the Joint Information Systems Committee - see Endnote)

Data Collection Funder: Office for National Statistics

Original Data Creator: Office for National Statistics

Depositor: Office for National Statistics

Registrar: Census Registration Service (University of Essex)

Copyright and source information

Crown copyright: Census output remains Crown copyright.

Copyright statement: The source of the census output should be prominently displayed whenever the census output is published, e.g. "Source: 2001 Census: Special Workplace Statistics (England, Wales and Northern Ireland)".

Confidentiality: Census output incorporates safeguards against possible identification of any particular person or household. The licensee shall not use the census output to attempt to obtain or derive information relating specifically to an identifiable individual or household, nor claim to have obtained or derived such information.

Citation: Office for National Statistics, 2001 Census: Special Workplace Statistics (England, Wales and Northern Ireland) [computer file]. ESRC/JISC Census Programme, Centre for Interaction Data Estimation and Research (University of Leeds).

Note for 1991 SWS Set C (2001 geography):

"© Source: ESRC-funded Estimating with Confidence project, incorporating copyright 1991 census data from ONS"

10. 2008 Accessibility Indicators: D.f.T.

The material featured on the Dept. for Transport website is subject to ©Crown copyright protection unless otherwise indicated. You may use and re-use the information featured on this website (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence for public sector information [http://www.nationalarchives.gov.uk/doc/open-government-licence/]

11. Quality of Life Indicators: Audit Commission

Available from the Audit Commission and The Places Database, Hub Download [http://www.places.communities.gov.uk/download.aspx]. Data is subject to to ©Crown copyright protection unless otherwise indicated. You may use and re-use the information featured on this website (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence for public sector information. [http://www.nationalarchives.gov.uk/doc/open-government-licence/]

12. Population Turnover statistics: Neighbourhood Statistics

All material on the Office for National Statistics (ONS) website is subject to Crown Copyright protection unless otherwise indicated. Under the terms of the Open Government Licence (OGL) and UK Government Licensing Framework, anyone wishing to use or re-use ONS material, whether commercially or privately, may do so freely without a specific application for a licence, subject to the conditions of the OGL and the Framework. Where data was reproducing ONS content without adaptation, the a source accreditation to ONS is as follows: Source: Office for National Statistics licensed under the Open Government Licence v.1.0. Where data was reproducing ONS content which was adapted, the source accreditation to ONS is as follows: Adapted from data from the Office for National Statistics licensed under the Open Government Licence v.1.0.

Summary of digital data sources:

Dataset	Variables	Source
Census Unit boundaries for GIS	Enumeration Districts, Output Areas, Super Output Areas & Wards	EDINA: UK Borders
Census data: variables by tables	2001 census	Office of National Statistics (ONS) DVDs & website
Output Area Classification typology (OAC) [a.k.a. The National Classification of Census Output Areas]	2001 census	National Statistics Online website
CORINE land-cover maps	2000	European Environment Agency
Indices of Multiple Deprivation (IMD)	2004 and 2007	Dept. for Communities & Local Government (DCLG) and formally the Office of the Deputy Prime Minister (ODPM)
Integrated Network Data (ITN)	2010	EDINA Digimap download service
MasterMap Address Layer2	Dwellings and Facilities as point data for GIS (2009)	Ordnance Survey (OS)
Kent Police Crime Statistics	mid-2007-mid-2008	Kent County Constabulary
Special Workplace Statistics level 2 (SWS)	2001 census	CIDER / WICID (census.ac.uk) at Leeds University
Carstairs Deprivation Scores	1981, 1991 & 2001	Dr Paul Norman, School of Geography University of Leeds
Means of Travel to Work census tables	1981, 1991, 2001	Census Dissemination Unit at Minnas (Univ. of Manchester)
Percentage claiming JSA	2008 Accessibility Indicators, Employment sub-domain	Dept. for Transport (DFT) website
Jobs accessible in <20mins	2008 Accessibility Indicators, Employment sub-domain	Dept. for Transport (DFT) website
Housing Tenure (KS table 18)	2001 census table	Census Dissemination Unit at Minnas (Univ. of Manchester)
Quality of Life indicators	2007 round	Audit Commission / The Places Database website
Population turnover	mid-2006-mid-2009	ONS SAPE team at Neighbourhood Statistics website

Main bibliography

-
- Abada, T., Hou, F. & Ram, B. (2007) Racially mixed neighborhoods, perceived neighborhood social cohesion, and adolescent health in Canada *Social Science & Medicine*, 65, 2004-17.
- Achuthan, K., Titherage, H. & Mackett, R. (2010) Mapping accessibility differences for the whole journey and for socially excluded groups of people. *Journal of Maps*, 2010, 220-29.
- Al-Kodmany, K. (2003) Web-based Tools and Interfaces for Participatory Planning. IN GEERTMAN, S. & STILLWELL, J. (Eds.) *Planning Support Systems in Practice*. Berlin, Springer-Verlag.
- Allen, C. (2008) *Housing market renewal and social class*, London, Routledge.
- Anderson, I. (2000) Housing and social exclusion: the changing debate. IN ANDERSON, I. & SIM, D. (Eds.) *Social Exclusion and Housing: Context and Challenges*. Coventry, Chartered Institute of Housing.
- Arentze, T. A., Borgers, A. & Timmermans, H. (1994) Multistop-based measurements of accessibility in a GIS environment. *International Journal of Geographical Information Systems*, 8, 343-56.
- Argyris, C. & Schön, D. (1974) *Theory in practice: Increasing professional effectiveness*, San Francisco, Jossey Bass.
- Asensio, J. (2002) Transport mode choice by commuters to Barcelona's CBD. *Urban Studies*, 39, 1881-95.
- Ashford Best Placed (2008) High Speed 1 [online] <http://www.ashfordbestplaced.co.uk/ashford_closer_than_you_think/high_speed_1.aspx> [Accessed March 2009].
- Ashford Best Placed (2010) The Ashford Smartlink vision... making travel choice a reality [online] <www.ashfordbestplaced.co.uk/PDF/Brochure-FINAL.pdf> [Accessed May 2010].
- Ashford Borough Council (2004) Ashford Area Transport Study. Ashford, RPS: Planning Transport and Environment.
- Ashford Borough Council (2008) Local Development Framework: Core Strategy. Ashford, Ashford Borough Council.
- Ashford Borough Council (2011) Ashford's Growth [online] <http://www.ashford.gov.uk/about_the_borough/ashfords_growth.aspx> [Accessed July 2011].
- Ashford Town Talk (2011) M20 To Close As Footbridge Arrives [<http://www.ashford.towntalk.co.uk/news/d/19342/m20-to-close-as-footbridge-arrives/>].
- Atkins (2009) Assessing Social and Distributional Impacts in Transport Scheme Appraisal and Evaluation. London, Atkins Limited (for the Department for Transport)
- Atkins (2010) Assessing Social and Distributional Impacts in Transport Scheme Appraisal and Evaluation: Pilot Phase: Final Report. London, Atkins Limited (for the Department for Transport).
- Atkinson, R. (2000) Hidden costs of gentrification: displacement in central London. *Journal of Housing and the Built Environment*, 15, 307-26.
- Atkinson, R. & Kintrea, K. (2004) 'Opportunities and Despair, It's All in There': Practitioner Experiences and Explanations of Area Effects and Life Chances. *Sociology*, 38, 437-55.
- Audit Commission (2005) Local quality of life indicators - supporting local communities to become sustainable. A guide to local monitoring to complement the indicators in UK Government Sustainable Development Strategy. London.
- Audit Commission (2009) National Indicator Set (NIS) [online]<www.audit-commission.gov.uk/localgov/audit/nis/pages/default.aspx> [Accessed Sept. 2010].
- Audit Commission (2010) NI 175 Access to services and facilities by public transport, walking and cycling [<http://www.audit-commission.gov.uk/localgov/audit/nis/Pages/NI175acesstoservicesandfacilitiesbypublictransport,walkingandcycling.aspx>] Accessed August 2010.

- Ayeni, B. (1997) The design of spatial decision support systems. IN TIMMERMANS, H. (Ed.) *Decision Support Systems in Urban Planning*. London, E & FN Spon.
- Bafna, S. (2003) Space Syntax : A Brief Introduction to Its Logic and Analytical Techniques. *Environment and Behavior*, 35, 17-29.
- Bailey, N. & Manzi, T. (2008) Developing and sustaining mixed tenure housing developments. London, Joseph Rowntree Foundation / University of Westminster.
- Ball, M. & Maginn, P. J. (2005) Urban Changes and Conflict: Evaluating the Role of Partnerships in Urban Regeneration in the UK. *Housing Studies*, 20, 2-29.
- Banister, D. (2008) The sustainable mobility paradigm. *Transport Policy*, 15, 73-80.
- Banister, D. & Berechman, J. (2000) *Transport investment and economic development*, London, UCL Press.
- Banister, D. & Hickman, R. (2006) How to design a more sustainable and fairer built environment: transport and communications. *IEEE Proceedings of the Intelligent Transport System*, 153, 276-2914.
- Banister, D. & Marshall, S. (2000) *Encouraging Transport Alternatives: Good Practice in Reducing Travel*, London The Stationery Office.
- Banister, D. & Stead, D. (2004) Impact of information and communications technology on transport. *Transport Reviews*, 24, 611-32.
- Banister, D. & Thurstain-Goodwin, M. (2011) Quantification of the non-transport benefits resulting from rail investment. *Journal of Transport Geography*, 19, 212-23.
- Barfod, M. B., Salling, K. B. & Leleur, S. (2011) Composite decision support by combining cost-benefit and multi-criteria decision analysis. *Decision Support Systems*, 51, 167-75.
- Barry, B. (2002) Social Exclusion, Social Isolation, and Distribution of Income. IN HILLS, J., LE GRAND, J. & PIACHAUD, D. (Eds.) *Understanding Social Exclusion*. Oxford, Oxford University Press.
- Batty, M. (1995) Planning support systems and the new logic of computation. *Regional Development Dialogue*, 16, 1-17.
- Batty, M. (2005) *Cities and Complexity*, Cambridge, MA, MIT Press.
- Batty, M. (2007) Planning Support Systems: Progress, Predictions and Speculations on the Shape of Things to Come. CASA, UCL.
- Beatty, C., Foden, M., Lawless, P. & Wilson, I. (2008) New deal for communities: A synthesis of new programme wide evidence: 2006-07. London, Department for Communities and Local Government.
- Ben-Akiva, M. & Bonsall, P. (2004) Increasing the relevance and utility to practice of transportation research: panel discussion at the 9th World Conference on Transport Research. *Transport Policy*, 11, 101-04.
- Ben-Akiva, M. & Lerman, S. R. (1979) Disaggregate travel and mobility choice models and measures of accessibility. IN HENSHER, D. A. & STOPHER, P. R. (Eds.) *Behavioural travel modelling*. London, Croom Helm.
- Ben-Akiva, M. & Lerman, S. R. (1985) *Discrete choice analysis: theory and application to travel demand*, Cambridge, MA, MIT Press.
- Ben Akiva, M. & Lerman, S. R. (1985) *Discrete choice analysis: theory and application to travel demand*, Cambridge, MA, MIT Press.
- Berkhout, P. H. G., Muskens, J. C. & Velthuisen, J. W. (2000) Defining the rebound effect. *Energy Policy*, 28, 425-32.
- Bertalanffy, V. L. (1968) *General systems theory*, New York, Braziller.
- Bertolini, L. (1999) Spatial development patterns and public transport: the application of an analytical model in the Netherlands. *Planning Practice and Research*, 14, 199-210.
- Bertolini, L., Le Clercq, F. & Kapoen, L. (2005) Sustainable accessibility: a conceptual framework to integrate transport and land use plan-making. Two test-applications in the Netherlands and a reflection on the way forward. *Transport Policy*, 12, 207-20.
- Beyes, T. P. (2005) Observing observers. Von Foerster, Luhmann, and management thinking. *Kybernetes*, 34 448 - 59.
- Bianchini, F., Dawson, J. & Evans, R. (1992) Flagship Projects in Urban Regeneration. IN HEALEY, P., O'TOOLE, M. & USHER, D. (Eds.) *Rebuilding the City: Property-led urban regeneration*. London, Spon.
- Billig, M. & Churchman, A. (2003) Building walls of brick and breaching walls of separation. *Environment and Behavior*, 35, 227-59.

- Bishop, I. D. (1998) Planning support: hardware and software in search of a system *Computers, Environment and Urban Systems*, 22, 189-202.
- Blokland, T. (2003) *Urban Bonds, Social Relationships in an Inner City Neighbourhood*, Cambridge.
- Bolt, G. & Torrance, M. (2005) Stedelijke herstructurering en sociale cohesie. Utrecht / Den Haag, DGW Nether Partnership
- Booth, C. (1892-7) *Life and Labour of the people in London. Vol I-IV*, London, Macmillan.
- Booz & Temple (2011) HS2 London to the West Midlands. Appraisal of Sustainability. Main Report Volume 1. [online]
<http://highspeedrail.dft.gov.uk/sites/highspeedrail.dft.gov.uk/files/hs2-aos-report01_0.pdf> [Accessed July 2011]. London, Booz & Co, The Temple Group.
- Bourguignon, F., Ferreira, F. & Walton, M. (2006) Equity, Efficient and Inequality Traps: A Research Agenda. *Journal of Economic Equality*, 5, 235-56.
- Brail, R. (2008) *Planning Support Systems for Cities and Regions.*, Cambridge, MA, Lincoln Institute of Land Policy.
- Brail, R. & Klosteman, R. (Eds.) (2001) *Planning Support Systems: Integrating Geographic Information Systems, Models and Visualisation Tools*, Redlands, California.
- Breheny, M. (1978) The measurement of spatial opportunity in strategic planning. *Regional Studies*, 12, 463-79.
- Brockmann, H., Delhey, J., Welzel, C. & Yuan, H. (2009) The China Puzzle: Falling Happiness in a Rising Economy. *Journal of Happiness Studies*, 10, 387-405.
- Brodsky, A. E., O'campo, P. J. & Aronson, R. E. (1999) Psychological sense of community in community context: Multi-level correlates of a measure of psychological sense of community in low-income, urban neighborhoods. *Journal of Community Psychology*, 27, 659-79.
- Brown, P., Hirshfield, A. & Batey, P. (2000) Adding Value to Census Data: Public Sector Applications of the Super Profiles Geodemographic Typology. *Journal of Cities and Regions*, 10, 19-31.
- Brown, T. N. (2001) Measuring self-perceived racial and ethnic discrimination in social surveys. *Sociological Spectrum*, 21, 377-92.
- Browne, D. & Ryan, L. (2011) Comparative analysis of evaluation techniques for transport policies. *Environmental Impact Assessment Review*, 31, 226-33.
- Bruinsma, F. & Rietveld, P. (1998) The accessibility of European cities: theoretical framework and comparison of approaches. *Environment and Planning A*, 30, 499 – 521.
- Brundtland Commission (1983) World Commission on Environment and Development (WCED).
- Brundtland Commission (1987) Our Common Future. Oxford University Press, United Nations World Commission on Environment and Development (WCED).
- Bryde, D. J. & Brown, D. (2008) The influence of a project performance measurement system on the success of a contract for maintaining motorways and trunk roads. *Project Management Journal*, 35, 57-65.
- Buchanan, C. & Volterra (2009) Economic Impact of High Speed 1: Final report. London, Colin Buchanan & Volterra: Commissioned by London & Continental Railways.
- Building.co.uk (2009) Ebbsfleet delay prompts McGuckin to leave Land Secs [online]
<<http://www.building.co.uk/news/ebbsfleet-delay-prompts-mcguckin-to-leave-land-secs/3133795.article>> [Accessed Aug. 2009].
- Burdge, R. (2004) *The Concepts, Process and Methods of Social Impact Assessment*, Middleton (WI), Social Ecological Press.
- Burdge, R. & Vanclay, F. (1996) Social Impact Assessment: A contribution to the State of the Art series. *Impact Assessment*, 14, 59-86.
- Burgess, J., Stirling, A., Clark, J., Davies, G., Eames, M., Mayer, M., Staley, K. & Williamson, S. (2007) Deliberative Mapping: developing an analytic-deliberative methodology to support contested science-policy decisions. *Public Understanding of Science*, 16, 299-322.
- Burkhardt, J. D. (1971) Impact of highways on urban neighborhoods: A model of social change. *Highway Research Record*, 356, 85-94.
- Butcher, L. (2010a) Railways: Channel Tunnel Rail Link Act 1996. Standard Note:SN/BT/70. London, House of Commons Library.
- Butcher, L. (2010b) Transport and Works Act 1992 [Standard Note: SN/BT/103] London, House of Commons Library Standard Notes.

- Butcher, L. (2011) Railways: Channel Tunnel Rail Link (HS1): Standard Note: SN/BT/267. London, House of Commons Library.
- Byrne, D. (1997a) Chaotic Places or Complex Places. IN WESTWOOD, S. & WILLIAMS, J. (Eds.) *Imagining cities : scripts, signs, memory*. London Routledge.
- Byrne, D. (1997b) Complexity Theory and Social Research. *Social Research Update*, 18, [Available online <http://sru.soc.surrey.ac.uk/SRU18.html>] Accessed June 2010.
- C.f.I.T. (2004) High-speed rail: international comparisons. London, Commission for Integrated Transport.
- C.I.C. (2007a) Themes, Messages and Challenges: A Summary of Key Themes from the Commission for Cohesion and Integration Consultation. London, Commission for Cohesion and Integration.
- C.I.C. (2007b) Our Shared Future. London, Commission on Integration and Cohesion.
- Caldiera, T. (1999) Fortified enclaves. IN Low, S. (Ed.) *Theorizing the City*. New Brunswick, NJ, Rutgers University Press.
- Cameron, S. (2006) From low demand to rising aspirations: Housing market renewal within regional and neighbourhood regeneration policy. *Housing Studies*, 21.
- Cameron, S. & Coaffee, J. (2006) Housing market renewal as urban revanchism? *Revenge and Renewal Conference*. University of Newcastle.
- Campagna, M., Campagna, A. & Deplano, G. (2006) PSS design: a general framework perspective. *International Journal of Environmental Technology and Management*, 1-2, 163 - 79
- Campari, I. (1996) Uncertain boundaries in urban space. IN BURROUGH, P. & FRANK, A. (Eds.) *Geographic Objects with Indeterminate Boundaries*. London, Taylor & Francis.
- Carr-Hill, R. & Sheldon, T. (1991) Designing a deprivation payment for general practitioners: the UPA8 wonderland. *British Medical Journal*, 302, 750-55.
- Carstairs, V. & Morris, R. (1989) Deprivation, mortality and resource allocation. *Community Medicine*, 11, 364-72.
- Cartmel, F. & Furlong, A. (2000) Youth unemployment in rural areas. Work and Opportunity Series No. 18. Joseph Rowntree Foundation.
- Carver, S. (1999) Developing web-based GIS/MCE: Improving access to data and spatial decision support tools. IN THILL, J. C. (Ed.) *Spatial multicriteria decision making and analysis : a geographic information sciences approach*. Aldershot, Ashgate.
- Casas, I. (2003) Evaluating the importance of accessibility to congestion response using a GIS-based travel simulator. *Journal of Geographical Systems*, 5, 109-27.
- Cass, N., Shove, E. & Urry, J. (2005) Social exclusion, mobility and access. *The Sociological Review*, 53, 539-55.
- Caulder, A., Medland, A., Dent, A. & Allen, P. (2009) Understanding patterns of deprivation. *Regional Trends*, 41, 93-114.
- Chan, J., To, H.P. & Chan, E. (2006) Reconsidering Social Cohesion: Developing a Definition and Analytical Framework for Empirical Research. *Social Indicators Research*, 75, 273-302.
- Chang, J. S. & Lee, J.-H. (2007) Accessibility Analysis of Korean High-speed Rail: A Case Study of the Seoul Metropolitan Area. *Transport Reviews*, 28, 87-103.
- Chapman, A. (2009) Demographic Classifications (www.businessballs.com/demographicclassifications) Accessed July 2009.
- Chapman, J. (2004) System failure: Why governments must learn to think differently. 2nd Ed. London, Demos.
- Checkland, P. (1981) *Systems Thinking, Systems Practice*, Chichester, John Wiley & Sons.
- Church, R., Frost, M. & Sullivan, K. (2000) Transport and social exclusion in London. *Transport Policy* 7, 195-205.
- Church, R. & Marston, J. (2003) Measuring accessibility for people with disability. *Geographical Analysis* 35, 83-96.
- Clare, J., Fernandez, J. & Morgan, F. (2009) Formal Evaluation of the Impact of Barriers and Connectors on Residential Burglars' Macro-Level Offending Location Choices. *Australian and New Zealand Journal of Criminology*, 42, 139-58.
- Clark, J., Burgess, J., Stirling, A., Studd, K., Chilvers, J. & Lewis, S. (2001) Local Outreach. Report to the UK Environment Agency, R&D Technical Report SWCON 204. London, University College Environment and Society Research Unit.
- Clark, J. M., Hutton, B. J., Burnett, N., Hathway, A. & Harrison, A. (1991) The appraisal of community severance. Wokingham, TRL.

- Coffé, H. & Geys, B. (2007) Participation in bridging and bonding associations and civic attitudes. *Voluntas: International Journal of Voluntary and Nonprofit Organizations*, 18, 385-406.
- Cohen, A. (1985) *The symbolic construction of community*, London, Tavistock.
- Cohesion Institute Website ([accessed 2008])
www.cohesioninstitute.org.uk/Resources/Toolkits/Health/TheNatureOfCommunityCohesion/MeasuringCommunityCohesion
- Coleman, J. S. (1957) *Community Conflict*, New York, Free Press.
- Commins, N. & Nolan, A. (2011) The determinants of mode of transport to work in the Greater Dublin Area. *Transport Policy*, 18, 259-68.
- Commission of European Communities (1994) The future development of the Common Transport Policy: a global approach to the construction of a community framework for sustainable mobility.
- Conklin, J. (2005) Wicked Problems and Social Complexity. IN CONKLIN, J. (Ed.) *Dialogue Mapping: Building Shared Understanding of Wicked Problems*. Wiley.
- Couch, C., Sykes, O. & Borstinghaus, W. (2011) Thirty years of urban regeneration in Britain, Germany and France: The importance of context and path dependency *Progress in Planning*, 75, 1-52.
- Countryside Properties (2006) Planning granted for the first phase of Ebbsfleet Valley: Press Release [online]
http://www.ebbsfleetvalley.com/newsletters/Planning_Granted_Springhead.pdf
 [Accessed Sept. 2007].
- Crossland, M. D., Wynne, B. E. & Perkins, W. C. (1995) spatial decision support systems: An overview of technology and a test of efficacy. *Decision Support Systems*, 14, 219-35.
- Crow, G. (2002) *Social Solidarities: Theories, Identities and Social Change*, , Buckingham, UK, Open University Press.
- Crowe, J. (2010) Community attachment and satisfaction: the role of a community's social network structure. *Journal of Community Psychology*, 38, 622-44.
- Crozet, Y. (2006) OECD Futures Project on Global Infrastructure Needs: Prospects and Implications for Public and Private Actors: Assessing the Long-Term Outlook for Current Business Models in the Construction and Provision of Urban Mass Transit Infrastructure and Services. Paris, OECD.
- D.C.L.G. (2004) Planning Policy Statement 11: Regional Spatial Strategies London, Department for Communities and Local Government.
- D.C.L.G. (2006) Thames Gateway Interim Plan: Development Prospectus. London, Department for Communities and Local Government.
- D.C.L.G. (2007a) The English Indices of Deprivation 2007 [online]
www.communities.gov.uk/documents/communities/pdf/733520.pdf [Accessed Nov. 2010].
- D.C.L.G. (2007b) Planning for a Sustainable Future. White Paper [Cm7120]. London, Department for Communities and Local Government. Department for the Environment, Food and Rural Affairs. Department of Trade and Industry. Department for Transport.
- D.C.L.G. (2008a) Design to Delivery: eco-towns transport worksheet. Advice to Promoters and Planners. London, TCPA / Dept. for Communities and Local Government.
- D.C.L.G. (2008b) Guidance for local authorities on community cohesion contingency planning and tension monitoring. London, Dept. for Communities and Local Government.
- D.C.L.G. (2008b) Guidance for local authorities on community cohesion contingency planning and tension monitoring. London, Communities and Local Government.
- D.C.L.G. (2009) Multi-criteria analysis: a manual. London, Department for Communities and Local Government.
- D.C.L.G. (2010a) Guidance for Local Planning Authorities following the revocation of Regional Strategies [online] at
<http://www.communities.gov.uk/documents/planningandbuilding/pdf/1631904.pdf>
 [Accessed July 2011]. London, Department for Communities and Local Government.
- D.C.L.G. (2010b) The New Deal for Communities Evaluation: Final report – Volume 7 Executive Summary. London, Dept. for Communities and Local Government.
- D.C.L.G. (2010c) The New Deal for Communities Experience: A final assessment The New Deal for Communities Evaluation: Final report – Volume 7. London, Dept. for Communities and Local Government.

- D.C.L.G. (2010d) Policy Statement on Regional Strategies. London, Department for Communities and Local Government.
- D.C.L.G. (2011) Planning Policy Guidance 13: Transport. London, Department for Communities and Local Government.
- D.C.L.G. Committee (2010-11) Abolition of Regional Spatial Strategies: a planning vacuum. Second Report of Session 2010–11 [HC 517]. London, London: TSO.
- D.E.T.R. (1998) A New Deal for Transport, Better for Everyone. White Paper. London, Department for the Environment, Transport and the Regions.
- D.E.T.R. (1999) Structure plans: guide to procedures. London, Department of the Environment, Transport and the Regions.
- D.E.T.R. (2000) Guidance on the Methodology for Multi-Modal Studies (GOMMMS). London, Department of the Environment, Transport and the Regions.
- D.F.T. (2005) Community Severance [UG569]. London, Department for Transport.
- D.F.T. (2006a) Regional Spatial Strategies: Guide to Producing Regional Transport Strategies. London, Department for Transport.
- D.F.T. (2006b) Social Inclusion: Transport Aspect. Imperial College, Mott MacDonald and Institute for Transport Studies, Leeds University for Department for Transport.
- D.F.T. (2008) Social Exclusion [online] <<http://www2.dft.gov.uk/pgr/inclusion/se/index.html>> [Accessed May 2011]. London, Department for Transport.
- D.F.T. (2009a) 2007 Core Accessibility Indicators: Guidance Notes [online] <<http://www.dft.gov.uk/pgr/statistics/datatablespublications/ltf/coreaccessindicators2007>> [Accessed June 2009]. London, Department for Transport.
- D.F.T. (2009b) 2008 Core National Accessibility Indicators - Final technical report. London, Department for Transport.
- D.F.T. (2009c) Impacts of Better Use Transport Interventions: Review of the Evaluation Evidence Base. London, Department for Transport.
- D.F.T. (2009d) NATA Refresh: Appraisal for a Sustainable Transport System. London, Department for Transport.
- D.F.T. (2010a) Evaluation [online] <<http://www.dft.gov.uk/topics/appraisal-evaluation/evaluation/>> [Accessed June 2011].
- D.F.T. (2010b) Guidance for Local Authorities seeking Government funding for major transport schemes: Interim Guidance on Local Authority Major Schemes. London, Department for Transport.
- D.F.T. (2011a) Review of decision making in the Department for Transport [press release] 27th April 2011. Available at <<http://www2.dft.gov.uk/press/speechesstatements/statements/hammond20110427.html>> [Accessed June 2011].
- D.F.T. (2011b) WebTAG [online] <www.dft.gov.uk/webtag/> [Accessed June 2011]. Department for Transport
- D.O.E. (1994) Assessing the Impact of Urban Policy (Ed.1). London, HMSO.
- D.O.E. (1995) The Thames Gateway Planning Framework: RPG9a. London, Department for the Environment.
- Davies, J. S. (2002) The Governance of Urban Regeneration: A Critique of the 'Governance Without Government' Thesis. *Public Administration*, 80, 301-22.
- Davoudi, S. (2011) From the IPC to the MIPU. *Planning in London*, 77, 34-35.
- De Palma, A. & Rochat, D. (2000) Mode choice for trips to work in Geneva: an empirical analysis. *Journal of Transport Geography*, 8, 43-51.
- Dennett, A. & Stillwell, J. (2008) Population turnover and churn: enhancing understanding of internal migration in Britain through measures of stability. *Population Trends*, 134, 24-41.
- Densham, P. J. (1991) Spatial decision support systems. IN MAGUIRE, D. J., GOODCHILD, M. F. & RHIND, D. (Eds.) *Geographical Information Systems: principles and applications*. Harlow, UK, Longman Scientific & Technical.
- DETR (2000) Social Exclusion and the Provision and Availability of Public Transport. London.
- DETR (1998) A New Deal for Transport, Better for Everyone. White Paper. London.
- Deveraux, E. C. (1960) Neighborhood and community participation. *Journal of Social Issues*, 16, 64-84.
- Diez, E. & McIntosh, B. (2009) A review of the factors which influence the use and usefulness of information systems. *Environmental Modelling & Software*, 24, 588-602

- Diez, E. & McIntosh, B. (2010) Organisational drivers for, constraints on and impacts of decision and information support tool use in desertification policy and management. *Environmental Modelling & Software*, 26, 317-27.
- Dimitriou, H. (2008) Mega Transport Projects, Globalization and Private Finance: Challenges for the Developing World. *CODATU VIII Conference*. Ho Chi Minh City.
- Dimitriou, H., Harman, R. & Ward, E. J. (2010) Incorporating Principles of Sustainable Development within the Design and Delivery of Major Projects: An international study with particular reference to Major Infrastructure Projects for the Institution of Civil Engineers and the Actuarial Profession. London, OMEGA Centre, Bartlett School of Planning, UCL.
- Dimitriou, H., Oades, R., Ward, J. & Wright, P. (2008) Generic Lessons for Improving The Treatment Of Risk, Uncertainty And Complexity in The Planning Of Mega Urban Transport Projects. Working Paper 4, OMEGA Centre. . Bartlett School of Planning ,UCL.
- Dissanayake, D. & Morikawa, T. (2005) Household travel behaviour in developing countries; nested logit model of vehicle ownership, mode choice and trip chaining. *Transportation Research Record*, 1805, 45-52.
- Dittmann, J. & Goebel, J. (2010) Your House, Your Car, Your Education: The Socioeconomic Situation of the Neighborhood and its Impact on Life Satisfaction in Germany *Social Indicators Research*, 96, 497-513.
- Dix, A., Finlay, J., Abowd, G. & Beale, R. (2004) *Human-Computer Interaction*, Harlow, UK, Pearson Education Limited.
- Dixon, J. & Durrheim, K. (2004) Dislocating identity: Desegregation and the transformation of place. *Journal of Environmental Psychology*, 24, 455-73.
- Drummond, W. & French, S. (2008) The Future of GIS in Planning: Converging Technologies and Diverging Interests. *Journal of American Planning Association*, 74, 161 - 74
- Duckenfield, T. (2009) Transport Needs Index. Steer Davies Gleave
[<http://areaclassification.org.uk/2000/01/01/files/2009/04/transport.pdf>].
- Dueker, K. & Ton, T. (2000) Geographic Information Systems for Transport. IN HENSHER, D. A. & BUTTON, K. J. (Eds.) *Handbook for Transportation Modelling*. Oxford, Pergamon.
- Egre, D. & Senecal, P. (2003) Social Impact Assessments of Large Dams Throughout the World: Lessons Learned Over Two Decades. *Impact Assessment and Project Appraisal*, 21, 215-24.
- Elvik, R. (2001) Cost-benefit analysis next term of road safety measures: applicability and controversies *Accident Analysis & Prevention*, 33, 9-17.
- Esteves, A. M. & Vanclay, F. (2009) Social Development Needs Analysis as a tool for SIA to guide corporate-community investment: Applications in the minerals industry *Environmental Impact Assessment Review*, 29, 137-45.
- Ettema, D. & Timmermans, H. (2007) Space-Time Accessibility Under Conditions of Uncertain Travel Times: Theory and Numerical Simulations. *Geographical Analysis*, 39, 217-40.
- Fastrack (2010) The journey begins... Fastrack Route B. From 8th May 2010 [online]
<http://www.go-fastrack.co.uk/images/stories/documents/fastrack_b_timetable_from_8-5-10_final.pdf> [Accessed Jan. 2011].
- Fastrack (2011) Fares & Tickets for Fastrack [online] <www.go-fastrack.co.uk/fares-a-tickets.html> [Accessed April 2011].
- Faunce, W. (2003) *Work, Status and Self-esteem: A Theory of Selective Self Investment* Lanham, University Press of America.
- Feitelson, E. (2002) Introducing environmental equity dimensions into the sustainable transport. *Transportation Research D*, 7, 99-118.
- Felsenstein, D., Persky, J. & Wiewel, W. (1997) Integrating hard-to-measure externalities into the evaluation of local economic development projects. *Town Planning Review*, 68, 55-79.
- Flint, J. & Casey, R. (2008) Adjacent Neighbourhood Effects: Case Study Report on Knowsley and Oxtang. Research Paper 1. Centre for Regional Economic and Social Research. Sheffield Hallam University.
- Flyvbjerg, B., Bruzelius, N. & Rothengatter, W. (2003) *Megaprojects and Risk: an anatomy of ambition*, Cambridge, Cambridge University Press.
- Fone, D. & Dunstan, F. (2006) Mental health, places and people: a multilevel analysis of economic inactivity and social deprivation. *Health & Place*, 12, 332-44.

- Fone, D., Dunstan, F., Lloyd, K., Williams, G., Watkins, J. & Palmer, S. (2007) Does social cohesion modify the association between area income deprivation and mental health? A multilevel analysis. *International Journal of Epidemiology*, 36, 338-45.
- Forkenbrock, D. J., Benshoff, S. & Weisbrod, G. E. (2001) Assessing the social and economic effects of transportation projects *NCHRP Report 456 (TRIS 00810856)*. Transportation Research Board (TRB).
- Fotheringham, S. & Wong, D. W. (1991) The modifiable areal unit problem in multivariate statistical analysis. *Environment and Planning A*, 23 1025-44.
- Friedkin, N. (2004) Social Cohesion. *Annual Review of Sociology*, 30, 409-25.
- Frost, M., Linneker, B. & Spence, N. (1998) Excess or wasteful communiting in a selection of British Cities. *Transportation Research A*, 32, 529-38.
- Fryer, P. (2009) What are Complex Adaptive Systems? A brief description of Complex Adaptive Systems and Complexity Theory [<http://www.trojanmice.com/articles/complexadaptivesystems.htm>] Accessed June 2010.
- G.S.R (2007) The Magenta Book: guidance notes for policy evaluation and analysis. Background paper 8: how do you know why (and how) something works? Qualitative methods of evaluation. London, Government Social Research Unit (H.M. Treasury).
- Gallent, N. & Robinson, S. (2011) Local perspectives on rural housing affordability and implications for the localism agenda in England. *Journal of Rural Studies*, In Press
- Gans, H. J. (1967) *The Levittowners*, New York, Pantheon.
- Gardner, G. (2007) Recognising the limits to community-based regeneration. *What is the added value of the community-based partnership approach? Lessons from the New Deal for Communities programme and beyond*. Brunei Gallery, School of Oriental and African Studies, London.
- Gatersleben, B., Clark, C., Reeve, A. & Uzzell, D. (2007) The impact of a new transport link on residential communities. *Journal of Environmental Psychology*, 27, 145-53.
- Geertman, S. & Ritsema Van Eck, J. R. (1995) GIS and models of accessibility potential: an application in planning. *International Journal of Geographical Information Science*, 9, 67-80.
- Geertman, S. & Ritsema Van Eck, J. R. (2004) GIS and models of accessibility potential: an application in planning. *International Journal of Geographical Information Science*, 9, 67-80.
- Geertman, S. & Stillwell, J. (2003a) Interactive Support Systems for Participatory Planning. IN GEERTMAN, S. & STILLWELL, J. (Eds.) *Planning Support Systems in Practice*. Berlin, Springer-Verlag.
- Geertman, S. & Stillwell, J. (Eds.) (2003b) *Planning Support Systems in Practice*, Berlin, Springer-Verlag.
- Geertman, S. & Stillwell, J. (2004) Planning Support Systems: an inventory of current practice. *Computers, Environment and Urban Systems*, 28, 291-310.
- Geertman, S. & Stillwell, J. (2009) Planning Support Systems: Content, Issues and Trends IN GEERTMAN, S. & STILLWELL, J. (Eds.) *Planning Support Systems Best Practice and New Methods*. Springer.
- Geurs, K. T. & Ritsema Van Eck, J. R. (2003) Evaluation of accessibility impacts of land-use scenarios: the implications of job competition, land-use, and infrastructure developments for the Netherlands. *Environment and Planning B*, 30, 69-87.
- Geurs, K. T. & Van Wee, B. (2004) Accessibility evaluation of land-use and transport strategies: review and research directions. *Journal of Transport Geography*, 12, 127-40.
- Ghosh, B. (1951) Random Distances Within a Rectangle and Between Two Rectangles. *Bulletin of Calcutta Mathematical Society*, 43, 17-24.
- Gibbs, J. P. & Martin, W. T. (1962) Urbanization, technology and the division of labor. *American Sociological Review*, 27, 667-77.
- Glaister, S. & Travers, T. (2001) London: Crossing London: Overcoming the Obstacles to CrossRail. *Public Money & Management* 21, 11-18.
- Gleason, J. (1975) A set covering approach to bus stop location. *Omega*, 3, 605-08.
- Glover, M. (2003) Channel Tunnel Rail Link section 1- an overview. Paper 13470. *ICE Civil Engineering*, 156, 5-11.
- Goldman, T. & Gorham, R. (2006) Sustainable urban transport: Four innovative directions. *Technology in Society*, 28, 261-73.

- Gospodini, A. (2005) Urban Development, Redevelopment and Regeneration Encouraged by Transport Infrastructure Projects: The Case Study of 12 European Cities. *European Planning Studies*, 13, 1083-111.
- Gourvish, T. (2004) *British Rail 1974-1997: From Integration to Privatisation* Oxford, Oxford University Press.
- Gourvish, T. (2006) *The official history of Britain and the Channel Tunnel*, London, Routledge.
- Gravesham Borough Council (2007) Kent Thameside development opportunity area map [online] <www.gravesham.gov.uk/media/images/r/j/KTDevelopmentMapLarge_1.gif>.
- Greenberg, S. W. & Rohe, W. M. (1984) Neighbourhood design and crime. A test of two perspectives. *Journal of American Planning Association*, 50, 48-60.
- Greene, D. L. & Wegener, M. (1997) Sustainable transport. *Journal of Transport Geography*, 5, 177-90.
- Grieco, M. (1994) *The Impact of Transport Investment Projects upon the Inner City*, Aldershot, Avebury.
- Guo, X., Black, J. & Dunne, M. (2001) Crossing pedestrians and dynamic severance on urban main roads. *Road & Transport Research*, 2001, [http://findarticles.com/p/articles/mi_qa3927/is_200109/ai_n8981050/pg_5/?tag=content;col1] Accessed April 2011.
- Gutiérrez, J. (2001) Location, economic potential and daily accessibility: an analysis of the accessibility impact of the high-speed line Madrid-Barcelona-French border. *Journal of Transport Geography* 9, 229-42.
- Gutierrez, J., Gonzalez, R. & Gomez, G. (1996) The European high-speed train network : Predicted effects on accessibility patterns. *Journal of Transport Geography*, 4, 227-38.
- Gutiérrez, J. & Urbano, P. (1996) Accessibility in the European Union: the impact of the trans-European road network. *Journal of Transport Geography* 4, 15-25.
- Guy, C. M. (1981) The assessment of access to local shopping opportunities : a comparison of accessibility measures. *Papers in planning research*. Cardiff University of Wales Institute of Science and Technology.
- H.M. Treasury (2003) *The Green Book*, London, TSO.
- H.M. Treasury (2010) National Infrastructure Plan 2010. London, H.M. Treasury.
- H.M. Treasury (2011) The Magenta Book: Guidance for evaluation (3rd Ed.). London, H.M. Treasury.
- H.S.T. Impact Consortium (2008) HST Impact Study: Final Report. Brussels, European Union.
- Hägerstrand, T. (1970) What about people in regional science? *People of the Regional Science Association*, 24, 7-21.
- Hahn, R. W. & Sunstein, C. R. (2002) A New Executive Order for Improving Federal Regulation? Deeper and Wider Cost-Benefit Analysis. *University of Pennsylvania Law Review*, 150, 1489-552.
- Halfacree, K. (1995) Talking about rurality: social representations of the rural as expressed by residents of six English parishes. *Journal of Rural Studies*, 11, 1-20.
- Handy, S. L. & Clifton, K. J. (2001) Evaluating Neighbourhood Accessibility: Possibilities and Practicalities. *Journal of Transportation and Statistics*, 4, 67-78.
- Handy, S. L. & Niemeier, D. A. (1997) Measuring accessibility: an exploration of issues and alternatives. *Environment and Planning A* 29, 1175-94.
- Hansen, W. G. (1959) How accessibility shapes land use. *Journal of the American Planning Institute*, 25, 73-76.
- Harris, B. (1989) Beyond geographical information systems: computing and the planning professional. *Journal of the American Planning Association*, 55, 85-90.
- Harris, B. (1999) Computing in Planning: professional and institutional requirements. *Environment and Planning B*, 26, 321-31.
- Harris, B. (2001) Accessibility: Concepts and Applications. *Journal of Transportation and Statistics*, 4, 15-30.
- Harris, B. & Batty, M. (2001) Locational Models, Geographic Information Systems and Planning Support Systems. IN BRAIL, R. & KLOSTEMAN, R. (Eds.) *Planning Support Systems*. Redlands, California, ESR.
- Haywood, R. (1999) South Yorkshire Supertram: its property impacts and their implications to integrated land use-transport planning. *Planning Practice and Research*, 14, 277-99.
- Helliwell, J. (2004) Well-Being and Social Capital: Does Suicide Pose a Puzzle? *NBER Working Paper No.10896*, 1-51.

- Hewitson, N. (2011) Nationally Significant Infrastructure Projects. *Planning in London*, 77, 32-33.
- Hewko, J., Smoyer-Tomic, K. E. & Hodgson, M. J. (2002) Measuring neighbourhood spatial accessibility to urban amenities: does aggregation error matter? *Environment and Planning A*, 34, 1185–206.
- Highways_Agency (2011) Post Opening Project Evaluation: Meta Analysis of Major Projects (Executive Summary May 2011). London, Highways Agency.
- Hillier, B. & Hanson, J. (1984) *The Social Logic of Space*, Cambridge, Cambridge University Press.
- Hine, J. (2007) Travel Demand Management and Social Exclusion. *Mobilities*, 2, 109-20.
- Hine, J. & Grieco, M. (2003) Scatters and clusters in time and space: implications for delivering integrated and inclusive transport *Transport Policy*, 10, 299-306.
- Hine, J. & Mitchell, F. (2001) The Role of Transport in Social Exclusion in Urban Scotland - Research Findings No.110 [Scottish Executive Central Research Unit]. Transport Research Institute, Napier University.
- Hine, J. & Mitchell, F. (2003) *Transport Disadvantage and Social Exclusion: Exclusionary Mechanisms in Transport in Urban Scotland*. , Aldershot, Ashgate Publishing.
- Hine, J. & Russell, J. (1993) Traffic barriers and pedestrian crossing behaviour *Journal of Transport Geography*, 1, 230-39.
- Hine, J. & Russell, J. (1996) Impact of traffic on pedestrian behaviour - 1. Measuring the traffic barrier. *Traffic Engineering and Control*, 37, 16-18.
- Hirschfield, A. & Bowers, K. J. (1997) The Effect of Social Cohesion on Levels of Recorded Crime in Disadvantaged Areas *Urban Studies*, 34, 1275 - 95
- Hirschfield, A., Brown, P. & Todd, P. (1995) GIS and the analysis of spatially referenced crime data: experiences on Merseyside. *International Journal of Geographical Information Systems*, 9, 191-210.
- Home Office (2003) Community Cohesion Advice for those designing, developing and delivering Area Based Initiatives. Building cohesion into regeneration and renewal. London, Home Office.
- Horner, A. (1999) The Tiger Stirring: Aspects of Commuting in the Republic of Ireland 1981-1996. *Irish Geography*, 32, 99-111.
- Horner, M. W. (2004) Exploring Metropolitan Accessibility and Urban Structure. *Urban Geography*, 25, 264-84.
- Horner, M. W. & Murray, A. T. (2002) Excess communuting and the modifiable areal unit problem. *Urban Studies*, 39, 131-39.
- House of Commons (2010) Hybrid Bills: Factsheet L5 Legislative Series. London, House of Commons Information Office.
- House of Commons (2011) Transport Committee - Tenth Report [HC1185-1]: High Speed Rail (HS2) [<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmtran/1185/118502.htm> Accessed November 2011].
- Hyde, R. & Reader, D. (1984) *Charles Booth's Descriptive Map of London Poverty, 1889, with introduction by Dr David Reeder*, London, London Topographical Society.
- Infrastructure Planning Commission (2011) Infrastructure Planning Commission: Our role [online] <<http://infrastructure.independent.gov.uk/who-we-are/our-role/>> [Accessed June 2011].
- Ingram (1971) The Concept of Accessibility: A Search for an Operational Form. *Regional Studies*, 5, 101-07.
- Ironside Farrar (2006) Airdrie to Bathgate Railway and Linked Improvements Bill - Chapter 12 Environmental Statement. Edinburgh.
- Jacobs, J. (1961) *The Death and Life of Great American Cities*, New York, Random House.
- Jain, R. (1980) Fuzzyism and real world problems. IN WANG, P. & CHANG, S. (Eds.) *Fuzzy sets; theory and application to policy analysis and information systems*. New York, Plenum Press.
- Jankowski, P. & Richard, L. (1994) Integration of GIS-based suitability analysis and multicriteria evaluation in a spatial decision support system for route selection. *Environment and Planning B*, 21, 323–40.
- Jenks, M. & Dempsey, N. (2007) Defining the Neighbourhood: challenges for empirical research. *Town Planning Review*, 78, 153-77.

- Jeon, C. M. & Amekudzi, A. (2005) Addressing Sustainability in Transportation Systems: Definitions, Indicators and Metrics. *Journal of Infrastructure Systems*, 11, 31-50.
- Jiang, B., Claramunt, C. & Batty, M. (1999) Geometric accessibility and geographical information: extending desktop GIS to space syntax. *Computers, Environment and Urban Systems*, 23, 127-46.
- Johnson, C. A. (2008) Access to social capital and the structure of inequality. IN LIN, N. & ERIKSON, B. (Eds.) *Social Capital: An International Research Program*. Oxford, Oxford University Press.
- Jones, P. & Evans, J. (2006) Urban Regeneration, Governance and the State: Exploring Notions of Distance and Proximity. *Urban Studies*, 43, 1491-509.
- Jordahl, H. (2009) Economic inequity. IN SVENDSEN, G. T. & SVENDSEN, G. L. (Eds.) *Handbook Of Social Capital*. Cheltenham, Elgar.
- Joseph, A. E. & Bantock, P. R. (1982) Measuring potential physical accessibility to general practitioners in rural areas: a method and case study. *Social Science and Medicine*, 16.
- Joy, D. (2011) London and Continental Railways [online]
<www.colinbuchanan.com/view/news/economic-impact-of-hs1> [Accessed July 2011].
- K.C.C. (2006) Local Transport Plan for Kent 2006-2011. Kent County Council.
- Kanter, R. M. (1968) Commitment and social organization: A study of commitment mechanisms in utopian communities. *American Sociological Review*, 33, 499-517.
- Kauffman, S. (1996) *At Home in the Universe: The Search for Laws of Complexity*, Harmondsworth, Penguin.
- Kent County Council (2010) Kent County Council 2009 Ward Level Population Estimates [<https://shareweb.kent.gov.uk/Documents/facts-and-figures/Population-and-Census/SAE1-10-2009-wards.pdf>].
- Kent County Council (2011) Research and Evaluation Statistical Bulletin: 2010 mid-year population estimates [online] <<https://shareweb.kent.gov.uk/Documents/facts-and-figures/Population-and-Census/mye1-11-mye2010-kent-gose.pdf>> [Accessed July 2011]. Maidstone, Kent County Council.
- Kent Police (2008) Crime Statistics June 2007 to June 2008 [online]
<http://www.kent.police.uk/news/latest_news/crime_stats_07_08.html> [Accessed Aug. 2009]
- Kent Thameside (2007) Kent Thameside - high speed regeneration. [online brochure]
<http://www.kent-thameside.co.uk/files/downloads/KT_Brochure.pdf> [Accessed Nov. 2007].
- Kenworthy, J. R. & Laube, F. B. (1999) Patterns of automobile dependence in cities: an international overview of key physical and economic dimensions with some implications for urban policy. *Transportation Research Part A: Policy and Practice* 33, 691-723.
- Kim, Y. O. & Penn, A. (2004) Linking the spatial syntax of cognitive maps to the spatial syntax of the environment. *Environment and Behavior*, 36, 483-504.
- Klosterman, R. (2001) Planning Support Systems: a new perspective on Computer-aided Planning. IN KLOSTERMAN, R. & BRAIL, R. (Eds.) *Planning Support Systems: Integrating geographic information systems, models, and visualization tools*. Redlands, California, ESRI.
- Knox, P. L. (1978) The intra-urban ecology of primary care: patterns of accessibility and their policy implications. *Environment and Planning A*, 10, 145-72.
- Koenig, J. G. (1980) Indicators of urban accessibility: theory and applications. *Transportation*, 9, 145-72.
- Kossinets, G. & Watts, D. J. (2009) Origins of Homophily in an Evolving Social Network. *American Journal of Sociology*, 115, 405-50.
- Kraus, V. & Koresh, Y. (1992) The course of residential segregation: Ethnicity, socioeconomic status and suburbanization in Israel. *Sociological Quarterly*, 33, 303-19.
- Kuper, L. (1953) Blueprint for living together. IN KUPER, L. (Ed.) *Living in Towns*. London, Cresset Press.
- Kurtz, C. & Snowden, D. (2003) The new dynamics of strategy: Sense-making in a complex and complicated world. *IBM Systems Journal*, 42, 462-83.
- Kwan, M.-P., Murray, A. T., O'Kelly, M. E. & Tiefelsdorf, M. (2003) Recent advances in accessibility research: Representation, methodology and applications. *Journal of Geographical Systems*, 5, 129-38.

- Kwok, R. & Yeh, A. (2004) The use of modal accessibility gap as an indicator for sustainable transport development. *Environment and Planning A*, 36, 921–36.
- Ladd, J. (2006) foreword. *Building*, February
- Land Securities (2008) Springhead Park is bucking the trend: Press Release April 2008 [online] <<http://www.ebbsfleetvalley.com/newsletters/Springhead%20Park%20-%20Launch%20of%20the%20show%20home%20April%202008.pdf>> [Accessed Aug. 2009].
- Landecker, W. S. (1951) Types of integration and their measurement. *American Journal of Sociology*, 56.
- Lang, L. (1999) *Transportation GIS*, Redlands, California, USA, ESRI.
- Laurini, R. (2001) *Information Systems for Urban Planning: A hypermedia co-operative approach*, London, Taylor & Francis.
- Lawless, P. (2004) Locating and explaining area-based initiatives: new deal for communities in England. *Environment and planning C: government and policy*, 22, 383-99.
- Lawless, P. & Dabinett, G. (1995) Urban regeneration and transport investment: a research agenda *Environment and Planning A*, 27, 1029-48.
- Lawless, P. & Gore, T. (1999) Urban Regeneration and Transport Investment: A Case Study of Sheffield 1992-96. *Urban Studies*, 36, 527-45.
- Layard, R. & Glaister, S. (Eds.) (1994) *Cost-benefit analysis (2nd Ed)*, Cambridge, Cambridge University Press.
- Lee, P. & Murie, A. (1997) *Poverty, housing tenure and 'social exclusion'*, Bristol, Policy Press.
- Lee, R., Booth, K., Reese-Smith, J., Regan, G. & Howard, H. (2005) The Physical Activity Resource Assessment (PARA) instrument: Evaluating features, amenities and incivilities of physical activity resources in urban neighborhoods. *International Journal of Behavioral Nutrition and Physical Activity*, 2, 1-9.
- Lefebvre, H. (1974) *La Production de l'Espace (published in English as "The Production of Space" 1991)*, Oxford, Blackwell.
- Lenoir, R. (1974) *Les Exclus*, Paris, Seuil.
- Levinson, D. (1998) Accessibility and the journey to work. *Journal of Transport Geography*, 6, 11-21.
- Levitas, R., Pantazis, C., Fahmy, E., Gordon, D., Lloyd, E. & Patsios, D. (2007) The multidimensional analysis of social exclusion: a research report for the Social Exclusion Taskforce. University of Bristol Department of Sociology and Public Policy.
- Lewin, R. (1993) *Complexity : life at the edge of chaos*, London, Dent.
- Litman, D. (2007) Well measured: Developing indicators for comprehensive and sustainable transport planning. Victoria, Australia, Victoria Transport Policy Institute.
- Liu, S. & Zhu, X. (2004) Accessibility Analyst: an integrated GIS tool for accessibility analysis in urban transportation planning *Environment and Planning B*, 31, 105-24.
- Lockie, S. F. (2009) Coal Mining and Resource Community Cycle; A Longitudinal Assessment of the Social Impacts of the Coppabella Coal Mine. *Environmental Impact Assessment Review*, 29, 330-39.
- Loftman, P. & Nevin, B. (1995) Prestige Projects and Urban Regeneration in the 1980s and 1990s: a review of benefits and limitations. *Planning Practice and Research*, 10, 299-315.
- Lucas, K. (2006) Providing transport for social inclusion within a framework for environmental justice in the UK. *Transportation Research Part A: Policy and Practice*, 40, 801-09.
- Lucas, K. & Currie, G. (2011) Developing socially inclusive transport policy: transferring the UK policy approach to the State of Victoria? *Transportation*, Online 4th Feb. 2011.
- Lucas, K., Marsden, G., Brooks, M. & Kimble, M. (2007) Assessment of Capabilities for Examining Long-Term Social Sustainability of Transport and Land Use Strategies. *Transportation Research Record*, 2013, 30-37.
- Lupton, R. & Power, D. (2002) Social Exclusion and Neighbourhoods. IN HILLS, J., LE GRAND, J. & PIACHAUD, D. (Eds.) *Understanding Social Exclusion*. Oxford, Oxford University Press.
- Lyons, G. (2003) The introduction of social exclusion into the field of travel behaviour. *Transport Policy*, 10, 339-42.
- Lyons, G. & Kenyon, S. (2003) Social participation, personal travel and Internet use. *Proceedings of the 10th International Conference on Travel Behaviour Research*. Lucerne.

- Maccoby, E. E., Johnson, J. P. & Church, R. M. (1958) Community integration and the social control of juvenile delinquency. *Journal of Social Issues*, 14, 38-51.
- Mackett, R., Lucas, L., Paskins, J. & Turbin, J. (2003) A methodology for evaluating walking buses as an instrument of urban transport policy *Transport Policy*, 10, 179-86.
- Mackett, R., Lucas, L., Paskins, J. & Turbin, J. (2005) Walking buses in Hertfordshire: impacts and lessons
<http://www2.cege.ucl.ac.uk/cts/research/chcaruse/Walking%20bus%20report%20-%20UCL.pdf> [Accessed May 2011]. London, UCL Centre for Transport Studies
- Maggean, J. & Nelson, J. (2003) The evaluation of demand responsive transport services in Europe *Journal of Transport Geography*, 11, 255-70.
- Mainzer, K. (1994) *Thinking in Complexity. The complex dynamics of Matter Mind and Mankind*, New York, Springer-Verlag.
- Makrí, M.-C. & Folkesson, C. (1999) Accessibility Measures for Analyses of Land-Use and Travelling with GIS (Lund University & University of Karlskrona, Sweden).
<http://www.trg.dk/td/papers/papers99/papers/paper/bpot/makri/makri.pdf>
- Makrí, M.-C. B. (2001) Accessibility Indices. A Tool for Comprehensive Land-Use Planning. Lund University, Sweden, <http://www.infra.kth.se/tla/tlenet/meet5/papers/Makri.PDF> (22 November 2006).
- Marshall, S. (2005) *Streets and Patterns*, London, Spon
- Martin, J. (2004) The Seven Samurai of Systems Engineering: Dealing with the Complexity of 7 Interrelated Systems. *Symposium of the International Council on Systems Engineering (INCOSE)*. Toulouse France.
- Martínez, F. J. & Araya, C. A. (2000) A Note on Trip Benefits in Spatial Interaction Models *Journal of Regional Science*, 40, 789-96.
- Masser, I. & Ottens, H. (1999) Urban Planning and GIS IN STILLWELL, J., GEERTMAN, S. & OPENSHAW, S. (Eds.) *Geographical information and planning*. New York, Springer.
- Massey, D. (1985) Ethnic residential segregation; a theoretical sythesis and empirical review. *Sociology and Social Research* 69, 345-50.
- McDowall, W. & Eames, M. (2006) Towards a Sustainable Hydrogen Economy: A Multi-criteria Mapping of the UKSHEC Hydrogen Futures. London, Policy Studies Institute.
- McPherson, M. & Smith-Lovin, L. (2002) Cohesion and membership duration: Linking groups, relations and individuals in an ecology of affiliation. *Advances in Group Processes*, 19, 1-36.
- Meadows, D. H., Meadows, D. L., Randers, J. & Behrens Iii, W. W. (1972) *The Limits to Growth*, New York, Universe Books.
- Mejia-Dorantes, L., Paezb, A. & Vassalloa, J. M. (In press (2011)) Transportation infrastructure impacts on firm location: the effect of a new metro line in the suburbs of Madrid. *Journal of Transport Geography*, [doi:10.1016/j.jtrangeo.2011.09.006].
- Merseyside County Council (1975) Merseyside structure plan, stage one report. Liverpool, Merseyside County Council.
- Miller, H. (2003) Travel chances and social exclusion. *10th International Conference on Travel Behaviour Research*. Lucerne
- Miller, H. J. (1991) Modelling accessibility using space-time prism concepts within geographical information systems. *International Journal of Geographical Information Science*, 5, 287-301.
- Mishan, E. J. & Quah, E. (2007) *Cost-benefit Analysis*, London, Routledge.
- Mokhtarian, P. L., Salomon, I. & Handy, S. L. (2006) The impacts of ICT on leisure activities and travel: A conceptual exploration. *Transportation*, 33, 263-89.
- Morgan, O. & Baker, A. (2006) Measuring Deprivation in England and Wales using the 2001 Carstairs Scores. *Health Statistics Quarterly*, 31, 28-33.
- Multicriteriamapping (2009) Multicriteria Mapping website [online]
www.multicriteriamapping.org [Accessed June 2011].
- Munoz-Raskin, R. (2010) Walking accessibility to bus rapid transit: Does it affect property values? The case of Bogotá, Colombia. *Transport Policy*, 17, 72-84.
- Murray, A. T., Davis, R., Stimson, R. J. & Ferreira, L. (1998) Public Transport Access. *Transportation Research D*, 3, 319-28.
- Murray, A. T. & Wu, X. (2003) Accessibility tradeoffs in public transit planning. *Journal of Geographical Systems*, 5, 93-107.
- Myddelton, D. R. (2007) *They Meant Well: Government Project Disasters*, London, Institute of Economic Affairs.

- N.L.E. Feasibility Studies (2008) Northern Line Extension: Transport Options and Appraisal reports www.northernlineextension.com/downloads.aspx.
- National Audit Office (2001) The Channel Tunnel Rail Link [HC302]. London, HMSO.
- National Statistics (2010) Output Area population [online] <http://www.statistics.gov.uk/geography/census_geog.asp#oa> [Accessed March 2010].
- Newman, P. & Kenworthy, J. (1980) Public and private transport in Australian cities: I. An analysis of existing patterns and their energy implications. *Transport Policy and Decision-making* 1, 133-48.
- Nicolas, J.-P., Pochet, P. & Poimboeuf, H. (2003) Towards sustainable mobility indicators: application to the Lyon conurbation. *Urban Transport Policy Instruments*, 10, 197-208.
- Nijkamp, P. (1994) Roads towards environmentally sustainable transport. *Transportation Research A*, 28, 261-71.
- Noble, M., McLennan, D., Wilkinson, K., Whitworth, A. & Barnes, H. (2008) The English Indices of Deprivation 2007. London, Communities and Local Government.
- Norton, R. (2008) Unintended Consequences. The Concise Encyclopedia of Economics.
- O'Faircheallaigh, C. (2009) Effectiveness in Social Impact Assessment: Aboriginal Peoples and Resource Development in Australia. *Impact Assessment and Project Appraisal*, 27, 95-110.
- O'Sullivan, D., Morrison, A. & Shearer, J. (2000) Using desktop GIS for the investigation of accessibility by public transport: an isochrone approach. *International Journal of Geographical Information Science*, 14, 85-104.
- O.D.P.M. (1999) Local Plans and Unitary Development Plans: A Guide to Procedures.
- O.D.P.M. (2001) A new commitment to neighbourhood renewal. London, Office of the Deputy Prime Minister.
- O.D.P.M. (2003) Sustainable Communities: Building for the Future. London, Office of the Deputy Prime Minister.
- O.D.P.M. (2005) Research Report 17: New Deal for Communities 2001-2005: An Interim Evaluation. Office of the Deputy Prime Minister / CRESR Sheffield Hallam University.
- O.N.S. (2001) Output Area Classifications: Cluster Summaries. London.
- O.N.S. (2008) Census look-up tables [online] <<http://www.ons.gov.uk/about-statistics/geography/products/geog-products-area/lookups/index.html>> [Accessed August 2008].
- O.N.S. (2009) Super Output Areas (SOAs): Frequently Asked Questions [online] <<http://www.neighbourhood.statistics.gov.uk/dissemination/Info.do?page=aboutneighbourhood/geography/superoutputareas/soafaq/soa-faq.htm>> [Accessed June 2009].
- O.N.S. (2010) Population Turnover Rates: Methodology. [online] <www.neighbourhood.statistics.gov.uk/HTMLDocs/images/Population_Turnover_Rates_Methodologyv01.pdf> [Accessed April 2011].
- O.N.S. (2011) nomis: official labour market statistics [online] <<http://www.nomisweb.co.uk/>> [Accessed July 2011].
- Oades, R. (2008) The significance of concepts of uncertainty, risk and complexity in decision-making and planning. UCL.
- Ogunlana, S. O. & Toor, S. (2010) Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects *International Journal of Project Management*, 28, 228-36.
- Omega_Centre (2007a) Methodology [online] <<http://www.omegacentre.bartlett.ucl.ac.uk/methodology/index.php>> [Accessed May 2011].
- Omega_Centre (2007b) Working Papers from OMEGA Project 1: Risk, Uncertainty & Complexity London, OMEGA Centre, Bartlett School of Planning, UCL.
- Omega_Centre (2011) Channel Tunnel Rail Link: Project Profile [online] <http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/UK_CTRL_PROFILE_080808.pdf> [Accessed May 2011].
- Omega_Website (2011) OMEGA Centre for Mega Projects in Transport and Development website: <http://www.omegacentre.bartlett.ucl.ac.uk>.
- Openshaw, S. & Openshaw, C. (1997) *Artificial Intelligence in Geography*, New York, John Wiley & Sons.

- Orford, S., Dorling, D., Mitchell, R., Shaw, M. & Davey Smith, G. (2002) Life and death of the people of London: a historical GIS of Charles Booth's inquiry. *Health & Place*, 8, 25-35.
- Orueta, F. D. & Fainstein, S. S. (2008) The New Mega-Projects: Genesis and Impacts. *International Journal of Urban and Regional Research*, 32, 759-67.
- Pacione, M. (2004) Where *will* people go? Assessing the new settlement option for the United Kingdom. *Progress in Planning*, 62, 73-129.
- Parkinson, M., Champion, A., Simmie, J., Turok, I., Crookston, M. & Katz, B. (2006) State of the English cities. London, Office of the Deputy Prime Minister.
- Pearce, J., Witten, K. & Bartie, P. (2006) Neighbourhoods and health: a GIS approach to measuring community resource accessibility.
- Peeters, M. & Elffers, H. (2010) Do physical barriers affect urban crime trips? The effects of a highway, railroad, park or canal on the flow of crime in The Hague. *Crime Patterns and Analysis*, 3, 38-49.
- Pennycook, F., Barrington-Craggs, R., Smith, D. & Bullock, S. (2001) Environmental Justice: Mapping transport and social exclusion in Bradford. Friends of the Earth
- Percy, S. (2003) New Agendas. IN COUCH, C., FRASER, C. & PERCY, S. (Eds.) *Urban Regeneration in Europe*. Oxford, Blackwell Series.
- Pickett, K. E. & Pearl, M. (2001) Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of Epidemiology and Community Health*, 55, 111-22.
- Pinto, J. K. & Slevin, D. P. (1988) Critical success factors across the project life cycle. *Project Management Journal* 19, 67-75.
- Planning Inspectorate (2004) The Planning Inspectorate: What we do [online] <http://www.planning-inspectorate.gov.uk/pins/statement_purpose/02_what_we_do.htm> Accessed June 2011.
- Planning Portal (2010) Local Plans. [online] <http://www.planningportal.gov.uk/planning/planningsystem/localplans> Accessed July 2011.
- Power, A. & Wilson, W. J. (2000) *Social Exclusion and the Future of Cities*, London, London School of Economics.
- Power, D. (2005) What is a Planning Support System? Bloomington, USA, iUniverse.com.
- Prest, A. R. & Turvey, R. (1965) Cost-benefit analysis: a survey. *The Economic Journal*, 75, 683-735.
- Preston, J. (2009) Epilogue: Transport policy and social exclusion - some reflections. *Transport Policy*, 16, 140-42.
- Preston, J. & Raje, F. (2007) Accessibility, mobility and transport-related social exclusion. *Journal of Transport Geography*, 15, 151-60.
- Preston, J. & Wall, G. (2008) The *Ex-ante* and *Ex-post* Economic and Social Impacts of the Introduction and High Speed Trains in South East England. *Planning, Practice & Research*, 23, 403-4022.
- Priya, T. & Uteng, A. (2009) Dynamics of transport and social exclusion: Effects of expensive drivers license. *Transport Policy*, 16, 130-39.
- Pucher, J. & Dijkstra, L. (2003) Promoting Safe Walking and Cycling to Improve Public Health: Lessons From The Netherlands and Germany. *American Journal of Public Health*, 93, 1509-16.
- Pushkaren, B. & Zupan, J. (1977) *Public Transportation and Land Use Policy*, Bloomington, University of Indiana Press.
- Putnam, R. D. (2007) E Pluribus Unum: Diversity and Community in the Twenty-first Century. *Scandinavian Political Studies*, 30, 137-74.
- Quaddus, M. A. & Siddique, M. A. B. (Eds.) (2004) *Handbook of sustainable development planning : studies in modelling and decision support*, Cheltenham Edward Elgar.
- R.T.P.I. (2011) Localism Bill: Lords Committee Stage: RTPI Briefing. London, Royal Town Planning Institute.
- Raco, M. (2005) A step change or a step back? The Thames Gateway and the re-birth of the Urban Development Corporations. *Local economy*, 20, 141-53.
- Rae, A. (2009) Isolated Entities or Integrated Neighbourhoods? An Alternative View of the Measurement of Deprivation. *Urban Studies*, 46, 1859-78.
- Rapoport, A. (1977) *Human aspects of urban form*, New York, Pergamon.

- Ratcliffe, J. H. (2001) Residential burglars and target selection. A quantitative study of the impact of Canberra's unique geography on residential burglary offenders. *Criminology Research Council*, 17.
- Recker, W. W., Chenb, C. & Macnally, M. G. (2001) Measuring the impact of efficient household travel decisions on potential travel time savings and accessibility gains. *Transportation Research Part A: Policy and Practice* 35, 339-69.
- Replogle, M. (1987) Sustainable Transport Strategies for Third World Development. *Human Powered Transportation and Transportation for Developing Countries*. Washington DC: Annual Meeting of the Transportation Research Board.
- Robson, B., Bradford, M., Deas, I., Hall, E., Harrison, E., Parkinson, M., Evans, R., Garside, P., Harding, A. & Robinson, F. (1994) Assessing the Impact of Urban Policy, Inner Cities Research Programme. London, HMSO.
- Rodrigue, J.-P., Comtois, C. & Slack, B. (2006) *Geography of Transport Systems* Abingdon, Oxon, Routledge.
- Rogers, R. (2005) Towards a Strong Urban Renaissance. London, Urban Task Force.
- Rossouw, N. & Malan, S. (2007) The Importance of Theory in Shaping Social Impact Monitoring: Lessons from the Berg River Dam, South Africa. *Impact Assessment and Project Appraisal*, 24, 291-99.
- Rowntree Society (2011) Rowntree Family Tree: Seebohm [<http://www.rowntreesociety.org.uk/rowntree-family/seebohm/>].
- Rutter, C. (2007) Kent Railways [online image] <http://en.wikipedia.org/wiki/File:Kent_Railways.svg> [Accessed May 2008].
- Salomon, I. & Mokhtarian, P. (1998) What happens when mobility-inclined market segments face accessibility-enhancing policies. *Transportation Research D*, 3, 129-40.
- Samset, K. (2008) How to overcome major weaknesses in mega projects: the Norwegian approach. IN PRIEMUS, H., FLYVBJERG, B. & VAN WEE, B. (Eds.) *Decision Making on Mega Projects: Cost-benefit analysis, planning and innovation*. Cheltenham, Edward Elgar.
- Schönfelder, S. & Axhausen, K. W. (2003) Activity spaces: Measures of social exclusion? *Transport Policy*, 10, 273-86.
- Seddon, J. (2008) *Systems thinking in the public sector : the failure of the reform regime and a manifesto for a better way*, Axminster, Triarchy Press.
- Seel, R. (1999) Complexity & Organisation Development: An Introduction {<http://www.new-paradigm.co.uk/complex-od.htm>} Accessed June 2010.
- Sen, A. (1985) *Commodities and Capabilities*, Oxford, Elsevier Science Publications.
- Sen, A. (1987) *The Standard of Living*, Oxford, Blackwell.
- Senior, M. (2002) Deprivation Indicators. IN REES, P., MARTIN, D. & WILLIAMSON, P. (Eds.) *The Census Data System*. Chichester, Wiley.
- Shaw, M. (2004) Housing and Public Health *Annual Review of Public Health*, 25, 397-418.
- Shaw, S.L. & Xin, X.-H. (2003) Integrated land use and transportation interaction: A temporal GIS exploratory data analysis approach. *Journal of Transport Geography*, 11, 103-15.
- Shen, Q. (1998) Locational characteristics of inner-city neighbourhood and employment accessibility for low-wage workers. *environment and Planning B*, 25, 345-65.
- Shergold, I. & Parkhurst, G. (2010) Operationalising sustainable mobility: the case of transport policy for older citizens in rural areas. *Journal of Transport Geography*, 18, 336-39.
- Sidlar, C. & Rinner, C. (2009) Utility assessment of a map-based online geo-collaboration tool. *Journal of Environmental Management*, 90, 2020-26.
- Sim, L. L., Yu, S. M. & Han, S. S. (2003) Public housing and ethnic integration in Singapore. *Habitat International*, 27, 293-307.
- Slotterback, C. S. (2010) Planners' perspectives on using technology in participatory processes. *Environment and Planning B*, 38, 468-85.
- Small, K. & Song, S. (1992) "Wasteful" Commuting: A Resolution. *The Journal of Political Economy*, 100, 888-98.
- Smithson, M. (2006) *Fuzzy set theory: applications in the social sciences*, Thousand Oaks, Sage Publications.
- Social Exclusion_Unit (1998) Bringing Britain together: a national strategy for neighbourhood renewal. London, Cabinet Office.
- Social Exclusion_Unit (2003) Making the Connections: Final Report on Transport and Social Exclusion. London, ODPM.

- Solutions4inclusion (2008) Social Exclusion Types [online]
www.esd.org.uk/solutions4inclusion/groupsearch.aspx [Accessed Nov. 2008].
- Song (1996) Some tests of alternative accessibility measures: A population density approach. *Land Economics*, 72, 474-82.
- Spain, D. (1992) A gentrification research agenda for the 1990s. *Journal of Urban Affairs*, 14, 125-34.
- Spicker, P. (2001) Poor Areas and the 'ecological fallacy'. *Radical Statistics*, 76, 1-6.
- Stanley, J. & Vella-Brodrick, D. (2009) The usefulness of social exclusion to inform social policy. *Transport Policy*, 16, 90-96.
- Steg, L. & Gifford, J. L. (2005) Sustainable transportation and quality of life. *Journal of Transport Geography*, 13, 59-69.
- Steinberg, S. & Steinberg, S. (2006) *GIS : geographic information systems for the social sciences*, London, Thousand Oaks.
- Steinitz, C. (2007) AGI Education Lecture: Early Years of the Havard Laboratory for Computer Graphics. UCL, May 2007.
- Stirling, A. (1997) Multi-criteria mapping: mitigating the problems of environmental valuation. IN J, F. (Ed.) *Valuing Nature*. London, Routledge.
- Straatemeier, T. (2006) How to plan for regional accessibility. Amsterdam, Institute for Metropolitan and International Development Studies.
- Sudiana, I. P. (2010) How effective is cost-benefit analysis in assisting decision making by public sector managers? Case studies of two Australian departments. *Policy and Governance Discussion Paper 10-01*. . Canberra, ACT: Crawford School of Economics and Government, The Australian National University.
- Talbot, S. (2010) Kings Cross Access: Battlebridge Road railway crossing
[\[http://webcache.googleusercontent.com/search?q=cache:-UDQawsw1nIJ:www.kingscrossaccess.com/+battlebridge+road+kings+cross&cd=1&hl=en&ct=clnk&gl=uk&client=firefox-a&source=www.google.co.uk\]](http://webcache.googleusercontent.com/search?q=cache:-UDQawsw1nIJ:www.kingscrossaccess.com/+battlebridge+road+kings+cross&cd=1&hl=en&ct=clnk&gl=uk&client=firefox-a&source=www.google.co.uk)
- Tate, F. N. (1997) Social Severance. *Transfund New Zealand Research Report No.80*.
- Tavistock_Institute (2010) Guidance for transport impact evaluations. Choosing an evaluation approach to achieve better attribution. London, Tavistock Institute & AECOM for the Department for Transport.
- Taylor, J. (2011a) Channel Tunnel Rail Link: two-page summary [online]
http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/UK_CTRL_2P_180711.pdf [Accessed May 2011].
- Taylor, J. (2011b) Rion- Antirion Bridge (Harilaos Trikoupi Bridge) Gulf of Corinth, Greece. OMEGA Centre Project Profile. London, OMEGA Centre, Bartlett School of Planning [http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/ANTIRION_PROFILE_291010].
- Taylor, J. (2011c) Sydney Cross-City Tunnel, OMEGA Centre Project Profile. London, OMEGA Centre, Bartlett School of Planning [http://www.omegacentre.bartlett.ucl.ac.uk/studies/cases/pdf/PROFILE_SYDNEY_260311.pdf].
- Terry, F. (2009) The History and Background of the Planning, Policy and Funding Frameworks of Mega Urban Transport Projects in the United Kingdom [Working Paper 1.9]. London, OMEGA Centre Working Paper series, Bartlett, UCL.
- The Economist (2001) Planning; less loathsome, perhaps. *The Economist* [November 10th].
- The Guardian (2011) *Secret Whitehall statistics to be published for the first time*
[\[http://www.guardian.co.uk/technology/2011/nov/28/secret-whitehall-statistics-published-data\]](http://www.guardian.co.uk/technology/2011/nov/28/secret-whitehall-statistics-published-data) Accessed Nov 2011.
- Thunhurst, C. (1985) The analysis of small area statistics and planning for health. *The Statistician*, 34, 93-106.
- Tira, M., Tiboni, M. & Badiani, B. (2002) High speed/high capacity railway and regional development - evaluation of effects on spatial accessibility. *42nd European Regional Science Association Congress*. Dortmund, Germany.
- Titherage, H. (2003) Social exclusion and transport policy. *Accessibility and User Needs in Transport, Scoping Study*. London, Department for Transport.
- Titheridge, H. (2003) Social exclusion and transport policy. *Accessibility and User Needs in Transport, Scoping Study*. London, Department for Transport.

- Townsend, P., Phillimore, P. & Beattie, A. (1986) Inequalities in Health in the Northern Region: an interim report. Newcastle upon Tyne and Bristol, Northern Regional Health Authority and the University of Bristol.
- Transport Committee (2011) Transport and the economy [HC 473] [online] <<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmtran/962/96203.htm>> [Accessed June 2011]. London, HM Government
- Transport Scotland (2007) Characteristics of Travel Mode and their Impacts [<http://www.transportscotland.gov.uk/files/documents/reports/j1294/j1294.pdf>] <Accessed Jan 2008>.
- Tschäppeler, R. & Krogerus, M. (2011) *The Decision Book: Fifty Models for Strategic Thinking*, London, Profile Books.
- Tudela, A., N., A. & Cisternas, R. (2006) Comparing the output of cost benefit and multi-criteria analysis: An application to urban transport investments. *Transportation Research A: Policy and Practice*, 40, 141-23.
- Tunstall, R. & Lupton, R. (2003) Is Targeting Deprived Areas an Effective Means to Reach Poor People? An assessment of one rationale for area-based funding programmes. CASEpaper 70. London, Centre for Analysis of Social Exclusion, London School of Economics.
- Turban, E. & Aronson, J. (1998) *Decision Support Systems and Intelligent Systems* Upper Saddle River, New Jersey, Prentice Hall.
- Tyler, P. & Rhodes, J. (2007) The single regeneration budget: Final evaluation. *Urban research summary No. 25*. London, Department for Communities and Local Government.
- Uran, O. & Janssen, R. (2003) Why are spatial decision support systems not used? Some experiences from the Netherlands *Computers, Environment and Urban Systems*, 27, 511-26
- Van Marassing, E., Bolt, G. & Van Kempen, R. (2006) Urban governance and social cohesion: Effects of urban restructuring policies in two Dutch cities. *Cities*, 23, 279-90.
- Van Wee, B., Hagoort, M. & Annema, J. A. (2001) Accessibility measures with competition. *Journal of Transport Geography*, 9, 199-208.
- Vanclay, F. (2003) International Principles For Social Impact Assessment. *Impact Assessment and Project Appraisal*, 21, 5-11.
- Vaughan, L. (2005) The relationship between physical segregation and social marginalisation in the urban environment. *World Architecture*, 185, 88-96.
- Vaughan, L. (2007) The spatial form of poverty in Charles Booth's London. *Progress in Planning* 67, 205-94.
- Vega, A. & Reynolds-Feighan, A. (2008) Employment sub-centres and travel to work mode choice in the Dublin region. *Urban Studies*, 45, 1747-68.
- Vickerman, R. W. (1974) Accessibility, attraction and potential; a review of some concepts and their use in determining mobility. *Environment and Planning A*, 6, 675-379.
- Vickers, D. & Rees, P. (2006) Introducing the Area Classification of Output Areas. *Populations Trends*, 125, 15-29.
- Vickers, D. & Rees, P. (2007) Creating the UK National Statistics 2001 output area classification. *Journal of Royal Statistical Society A*, 170, 379-403.
- Vonk, G., Geertman, S. & Schot, P. (2007) A SWOT analysis of planning support systems. *Environment and Planning A*, 39, 1699-714.
- Vonk, G. & Ligtenberg, A. (2010) Socio-technical PSS development to improve functionality and usability: Sketch planning using a Maptable. *Landscape and Urban Planning*, 94, 166-74.
- Vriens, D. & Hendricks, P. (1997) How to define problems: a systematic approach. IN TIMMERMANS, H. (Ed.) *Decision Support Systems in Urban Planning*. London, E & FN Spon.
- Waldrop, M. (1994) *Complexity: The Emerging Science at the Edge of Order and Chaos* (Penguin Science), Harmondsworth, Penguin.
- Walsh, J., Foley, R., Kavanagh, A. & McElwain, A. (2005) Origins, Destinations and Catchments: Mapping travel to work in Ireland in 2002. *Journal of the Statistical and Social Inquiry Society of Ireland*, 35, 1-55.
- Weber, J. & Kwan, M.-P. (2003) Evaluating the Effects of Geographic Contexts on Individual Accessibility: A Multilevel Approach. *Urban Geography*, 24, 647-71.

- Weber, R. (2009) Religio-philosophical roots. IN SVENDSEN, G. L. & SVENDSEN, G. T. (Eds.) *Handbook of Social Capital*. Cheltenham, Elgar.
- Wegener, M. & Fürst, F. (1999) Land use transport interaction: state of the art. Deliverable 2a of the project TRANSLAND of the 4th RTD Framework Programme of the European Commission. Universtat Dortmund, Institut für Raumplanung.
- Weibull, J. W. (1976) An axiomatic approach to the measurement of accessibility. *Regional Science and Urban Economics*, 6, 357-79.
- Werner, R. & Evans, G. (2011) Comparing stress of car and train commuters *Transportation Research Part F: Traffic Psychology and Behaviour*, 14, 111-16.
- White, P. (2009) *Public transport: Its planning, management and operation (5th Ed.)*, London, Routledge.
- Wilkinson, R. & Marmont, M. (Eds.) (2003) *Social Determinants of Health. 2nd Ed.*, Copenhagen, WHO.
- Williams, S. & Botterill, A. (2006) Profiling Areas using the Output Area Classification. *Regional Trends*, 32, 11-19.
- Wilson, A. G. (1970) *Entropy in urban and regional modelling*, London, Pion.
- Wilson, W. (1987) *The Truly Disadvantaged: The Inner City, The Underclass and Public Policy*, Chicago, University of Chicago Press.
- Wixey, S., Jones, P., Titherage, H. & Christodoulou, G. (2003) Measuring Accessibility as Experienced by Different Socially Disadvantaged Groups. Working Paper 2. London, Transport Studies Group - University of Westminster.
- Wolmar, C. (2011) Rail 670: Project assessment is a fiddle [online] <<http://www.christianwolmar.co.uk/2011/05/rail-670-project-assessment-is-a-fiddle/>> [Accessed June 2011].
- www.parliament.uk (2010-11) Localism Bill [<http://services.parliament.uk/bills/2010-11/localism.html>] Accessed June 2011.
- Yu, J.-H. & Kwon, H.-R. (2010) Critical success factors for urban regeneration projects in Korea. *International Journal of Project Management*, 2010.
- Zegras, C. (2011) Mainstreaming Sustainable Urban Mobility. IN DIMITRIOU, H. & GAKENHEIMER, R. (Eds.) *Transport Policy-making and Planning for Cities of the Developing World*. Draft chapter section saved in PDFs ed. Cheltenham, Edward Elgar.

10.1

Appendix:

Current transport planning policy in the U.K.

Transport policy is currently set primarily by the Department for Transport, headed by the Secretary for Transport and their team of transport ministers, but other departments also have concerns that shape policy. For example, the Treasury are involved in setting budgets, D.E.F.R.A. are influential regarding the environmental elements and D.C.L.G. drive planning policy (Butcher et al. 2010). Policy related to transport often has to find a balance between reducing the volume of movement in order to alleviate the negative impacts on the environment and society whilst not hindering economic prosperity and growth. This is encapsulated by the notion of individual preference vs. collective impacts when considering the arguments for and against transport policy (Terry 2009:20).

Several Green and White Papers, and Acts form the direction and scope of planning policy for transport in England, including the Town and Country Planning Act (T.C.P.A.) of 1947, which has been continually amended (e.g. T.C.P.A 1963 and TCP T.C.P.A A 1990) and has formed an influential backbone for transport planning, including the introduction of the Section 106 agreements.

Of note in the last 15 years, the 1996 Green Paper 'Transport - The Way Forward' [Cm3234] sought to encourage more sustainable, environmentally-friendly solutions to transport issues, a shift from previous policy which generally considered economic rewards as a dominant factor (an ideology promoting privatisation and competition) (Lyons et al. 1999).

The new Labour government continued with the sustainability theme, publishing the seminal transport White Paper; 'A New Deal for Transport: Better for Everyone' (D.E.T.R. 1998), which promoted alternative forms of transport to the car, investing in integrated public transport (and considering its impact on social exclusion) and tackling pollution and congestion (White 2002:189). However, there was a general decrease in road building, smaller schemes continued (Terry 2009:21).

The Transport Ten Year Plan White Paper (2000) designed to demonstrate how investments could be met and greater partnership between the private sector and local government, and greater integration in the system. (Terry 2009:22). Specific ten-year targets are also qualified including; a 50% increase in rail passengers, a new Urban Bus Challenge Fund to offer new bus links to under-served urban areas and a 'fairer society', through better access to jobs and services (D.f.T. 2000)

Following the Railways Act (1999) which allowed the privatisation of the British Railway network take place, the Transport Act (2000) covered a wide agenda for transport provision, including local transport (e.g.: bus strategies, fare concessions and the creation of Local Transport Plans) and railways (creation of the Strategic Rail Authority (SRA), and other details of railway privatisation). However, the SRA was seriously hampered by a lack of leadership and too few powers. The White Paper 'The Future of Rail' [Cm 6233] (D.f.T. 2004a) aimed at streamlining the structure of the railway system, greater accountability and cooperation between track and rolling stock operators. The SRA was disbanded and its remit transferred back to the Dept. for Transport (Terry 2009:22). Another White Paper, The Future of Transport [Cm 6234] (D.f.T. 2004b) presented a thirty-year strategy policy document for long-term investment and sustainable and equitable transport system growth across all modes.

Subsequent to the Eddington Report (2006) on transport, the Stern Review Report on the Economics of Climate Change (2006) and the Barker Review on housing supply (2004) and land-use planning (2006), the Labour government increased efforts to better integrate economic, social and environmental policy in a united overarching framework. This came together in a White Paper 'Planning for a Sustainable Future' [Cm 7120] (D.C.L.G. 2007) in the hope of speeding up the approval process for major infrastructure projects (including transport) and responding to concerns regarding climate change and globalisation. The newly established Commission for Integrated Transport (C.f.I.T), a quasi-autonomous body provided input for government transport policy, ensuring it's cohesion with other social, economic and environmental policy objectives that traditionally were the remit of several departments. [cfit.independent.gov.uk]. C.f.I.T was abolished in October 2010. The 2007 White Paper 'Delivering a Sustainable Railway' [Cm 7176] produced a document providing strategic direction for the rail industry following the 2005 Railways Act. It assessed the challenges anticipated over the next 30 years and ways to achieve goals related to safety, reliability and capacity.

Following the 2007 'Planning for a Sustainable Future' White Paper, the Planning Act of 2008 was concerned primarily with the creation of a unified infrastructure planning consent process at local, sub-regional and regional levels. This saw the creation of the Infrastructure Planning Commission, and clarification of the development application process for infrastructure projects of national importance, including railways and major roads. This entailed the creation of new National Policy Statements (NPSs), reviewed by the Secretary of State [www.legislation.gov.uk]. This marked a departure from previous years where there was an absence of an explicit mechanism for strategic national planning in infrastructure, including transport (Terry 2009:11). The Royal Town Planning Institute voiced serious concerns that there was too much of a reduction of democratic accountability and community

involvement, moving away from cohesive and empowered communities as advocated by the D.C.L.G. (R.T.P.I. 2008).

Also in 2008, the Local Transport Bill was given Royal Assent, and this updated several areas from the 2000 Transport Act (e.g. the Quality Partnership Schemes), plus the creation of the Integrated Transport Authorities. Also of note in this Act are the greater powers local authorities have to manage and amend bus services to meet passenger needs, encourage greater cooperation with private sector community transport services, and better support of bus passenger rights by expansion of the Passenger Focus rail watchdog remit (D.f.T. 2008).

Currently passing through the House of Lords (July 2011), the Localism Bill aims to give greater devolved powers to both local authorities and councils, and the local community regarding planning decisions. This removes them from the Secretary of State and this is to create a new permutation of the Planning Commission. Objections to the Bill's agenda include the lack of clarity in the developer's need to behave 'responsibly' and how development, which can potentially now take place where and how local people would wish, is 'sustainable' (e.g. Jenkins 2011). The RTPI and Civic Voice are also apprehensive regarding the extent to which economic, social and environmental concerns of sustainable development are being sidelined in favour of business interests, relegating the potential uses of the proposed Neighbourhood Forums (R.T.P.I. 2011).

There is an on-going National Planning Policy Framework consultation (July 2011) open for public debate, to discuss the potential changes to the planning system including making it more accessible, geared towards sustainability concerns and localist in its approach, and handing power back to the local community (D.C.L.G. 2011).

10.2

Appendix:

The Demographic Profiles indicator

South-east England Government Office Region (GOR): a wider comparison



Fig. 10.1: Counties of the SE England GOR (Wikipedia 2010)

As is evident in other impact indicator measures, Ashford and Ebbsfleet have socio-economically and demographically quite different characteristics but how do they compare to the larger context of the South-East England Government Office Region (GOR) (figs. 10.1 and 10.2)? This region is densely occupied, economically active in the tertiary sector occupations and prosperous (O.D.P.M. 2003, Couch et al. 2011).

To place the hubs in a wider geographical context, the OAC for SE England GOR is given; with the highest proportions being Thriving Suburbs (9%) Aspiring Households (8.7%) and Prospering Older households (8.5%) (figs. 10.3 and 10.4). These are followed by Least Divergent (8.3%), Accessible Countryside (6.8%) and Settled in the City (6.3%). As one might expect, Ashford 10km analysis zone shares the greatest similarities with the wider context distribution as both of these spatial units contain wealthier proportions of the population than occupy in and around Ebbsfleet. However there is more multicultural population in the SE England GOR than Ashford, although the reverse is true for Blue Collar Workers (11% in the GOR vs. 17% in Ashford 10km zone).



Fig. 10.2 SE England GOR boundary, London boundary and the 10km analysis zones for Ebbsfleet and Ashford over ©Google Maps (2010)

SE GOR Demographic Profiles

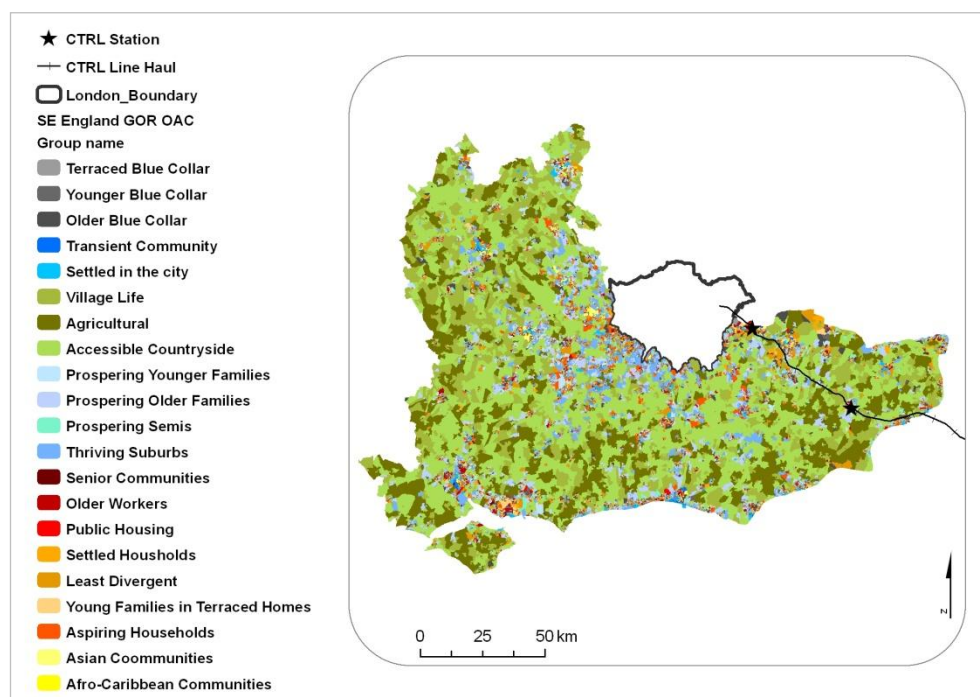


Fig. 10.3: SE England Government Office Region: OAC group [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

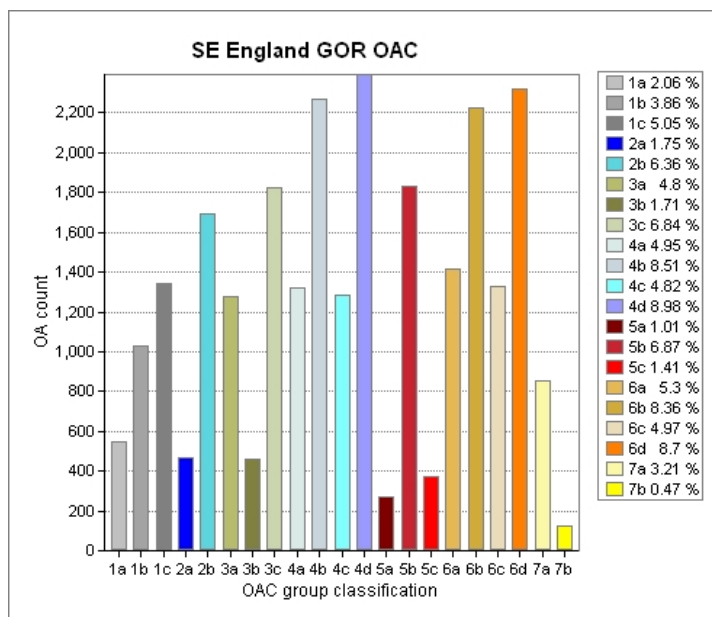


Fig 10.4 SE England Government Office Region: associated OAC bar chart

The table below (fig. 10.5) provides a basis for comparison for a country-wide comparison for the hubs with the SE England, England and the UK vs. other regions. For example, Ebbsfleet 34% in Typical Traits (Supergroup 6) is much higher than another other spatial unit, whilst Ashford's <1% Multicultural population (Supergroup 7) is only comparable to Northern Ireland.

	Percentage of individuals in each Supergroup							Total population (thousands) (= 100%)	Percentage of UK population within region
	1	2	3	4	5	6	7		
United Kingdom	16.7	6.1	12.5	23.1	10.9	19.3	11.5	58,789	100.0
North East	34.4	3.0	4.9	23.8	16.4	15.0	2.6	2,515	4.3
North West	19.7	3.3	7.2	26.3	13.0	24.0	6.5	6,730	11.4
Yorkshire and the Humber	21.2	3.3	10.6	22.5	11.4	23.2	7.7	4,965	8.4
East Midlands	19.2	2.3	17.6	30.6	7.7	16.3	6.3	4,172	7.1
West Midlands	18.7	2.4	11.5	24.9	10.9	17.4	14.3	5,267	9.0
East	15.3	4.0	18.0	27.4	9.2	21.7	4.3	5,388	9.2
London	2.7	18.1	0.1	8.4	2.2	10.7	57.8	7,172	12.2
South East	12.0	6.9	13.1	28.9	8.1	27.0	4.0	8,001	13.6
South West	13.3	5.6	25.4	19.8	8.3	26.3	1.2	4,928	8.4
England	15.6	6.2	11.7	23.3	9.1	20.6	13.5	49,139	83.6
Wales	25.6	2.7	20.3	19.4	10.5	19.8	1.6	2,903	4.9
Scotland	18.9	9.4	10.4	21.7	29.4	9.8	0.6	5,062	8.6
Northern Ireland	27.2	1.3	26.8	26.8	9.9	7.9	0.1	1,685	2.9

Fig. 10.5: Percentage of OAs in each OAC Supergroup by region in the UK (Williams and Botterill 2006:14)

10.3

Appendix:

Ashford Index of Diversity calculations

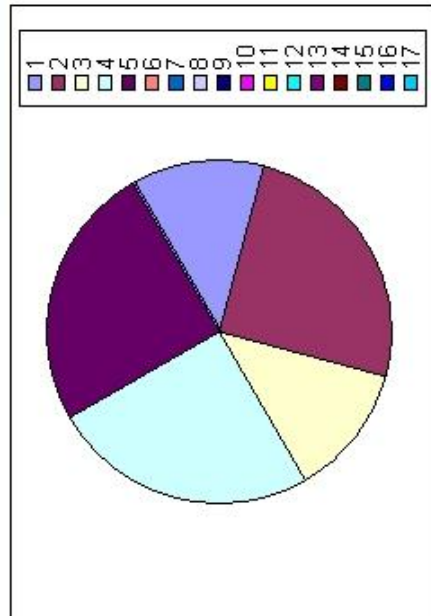
Ashford 10km WARDS

GROUP	n	n*(n-1)	(n/N) Sq
3a	1	0	0.015625
3c	2	2	0.0625
5b	1	0	0.015625
6b	2	2	0.0625
6d	2	2	0.0625

$$D = \frac{\text{sum of } n*(n-1)}{N*(N-1)} = \frac{0.107143}{0.892857}$$

$$1/D = 9.333333$$

$$D = \frac{\text{sum } (n/N)^2}{\text{sum } (n/N)} = \frac{0.21875}{0.78125} \text{ (used)}$$



8	6	0.21875
N	sum of n*(n-1)	

ward	IoD
29UBGZ	0.740741
29UBHA	0.845679
29UBHC	0.78125
29UBHD	0.816327
29UBHE	0.790123
29UBHF	0.78125
29UBHG	0.444
29UBHH	0.716049
29UBHX	0.754325
29ULGY	0.78125

ward	IoD
29UBHJ	0.791667
29UBHK	0.777778
29UBHL	0.65625
29UBHM	0
29UBHN	0.734694
29UBHP	0.777
29UBHQ	0.716049
29UBHR	0.867188
29UBHS	0.21875
29UBHT	0

ward	IoD
29UBHY	0.691358
29UBHZ	0.653061
29UBJA	0.666
29UBJB	0.87037
29UBJE	0.87037
29UBJF	0.734694
29UBJG	0.691358
29UBJH	0.666
29UBJK	0.828125
29UBJL	0.78125

Ebbfleet Index of Diversity calculations

10.5

Appendix:

The Socio-economic Deprivation indicator

The SE England Government GOR Indices of Deprivation

(See appendix 10.2 above for a detailed spatial boundary of this region)

The IMD 2004 for this Government Office Region (fig. 10.6: below) illustrates that the vast majority of this region is in the least deprived classification although it appears that the areas of higher deprivation are along the south coast, where the cities and towns of Southampton, Portsmouth, Brighton are located, and in coastal Kent, in the north-east.

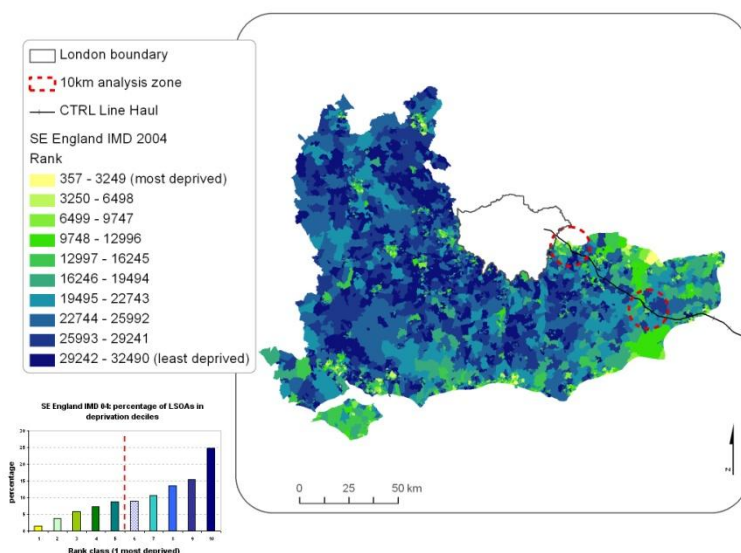


Fig. 10.6: SE England GOR: IMD 2004
[CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

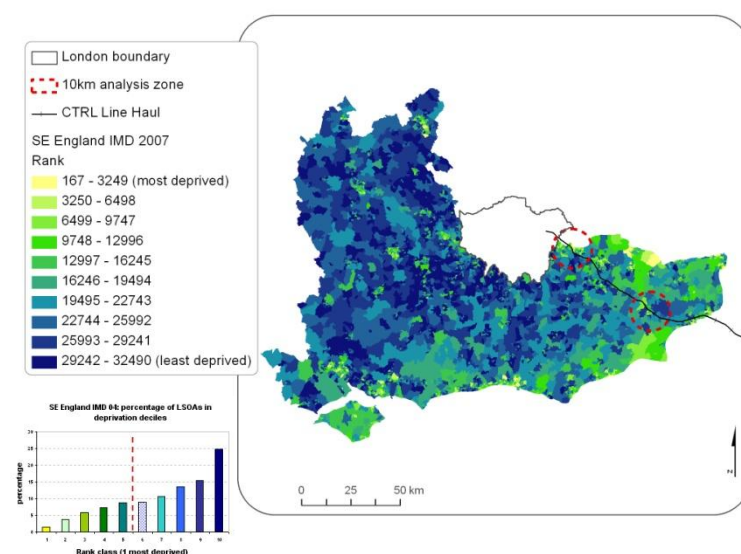


Fig. 10.7: SE England GOR: IMD 2007
[CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

The situation deteriorates slightly when examining the 2007 dispersion of deprivation fig. 10.7), as the areas of lower deprivation spread spatially, evident in the map below (fig. 10.8), where the majority of rank changes in the region, both coast and inland, have been negative.

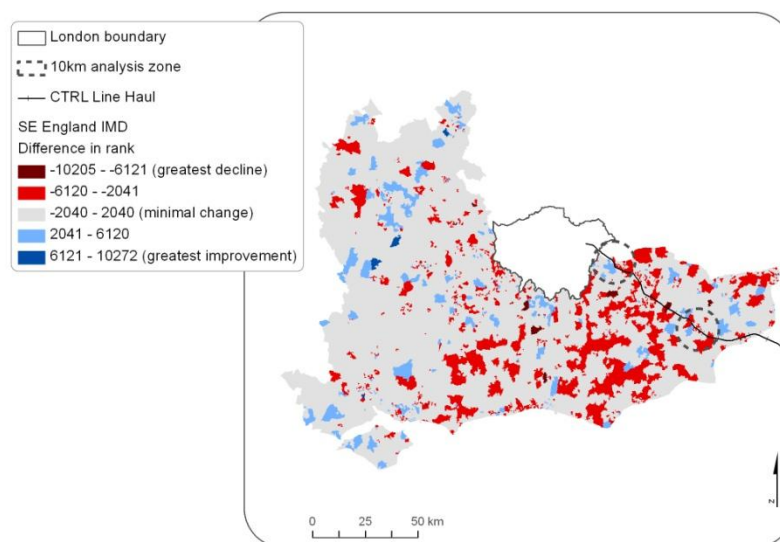


Fig. 10.8: SE England GOR: IMD changes in ranking 2004-7 [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

The box-plot (fig. 10.9) to the left however confirms that despite the increase in relative deprivation in some parts of the region, the south-east of England is ranked such that almost all of the inter-quartile values are located in the upper half of the range. The median does drop slightly from 23,696th in 2004 to 22,867th in 2007. The lower quartile 'whiskers' indicate that there are pockets of significantly deprived areas within the region, with the lowest ranking LSOA, 167th in England, on south-eastern coast of Kent near Margate.

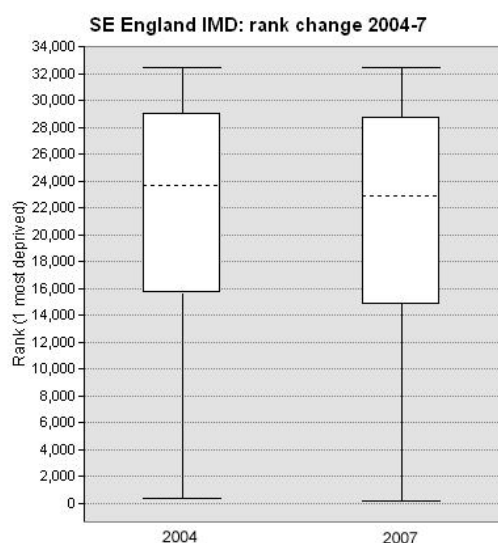


Fig. 10.9: Box plot: SE England GOR: IMD changes in ranking 2004-7

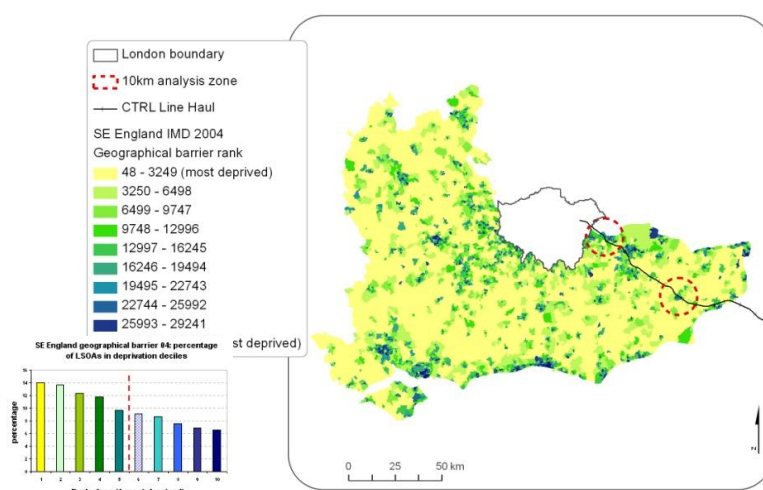


Fig. 10.10: SE England GOR: Geographical Barrier sub-domain 2004 [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

With regard to the Geographical Barriers sub-domain (fig. 10.10 above), the region has a high incidence of accessibility deprivation in the rural areas, the reverse of the general picture of combined IMD. There are concentrations of low accessibility-related deprivation in the coastal and smaller inland towns and cities such as Oxford, Reading, Maidstone and Tunbridge. The urban/rural fringe around the London boundary is also relatively well connected and accessibility to the key resources is generally ranked quite highly. In 2007 (fig. 10.11 below) the dispersal is on the whole static, with the ranking change map (fig. 10.12 also below) evidence that the rank changes are spatially isolated but there are some large changes for some LSOAs; one located in Gosport, Hampshire falling 20,684 rank places, and another Swale in inland Kent rising by 17,644 positions. The scale of such change in rankings again suggests that there has been a significant amendment to the local infrastructure, or is an artefact of the data capture process.

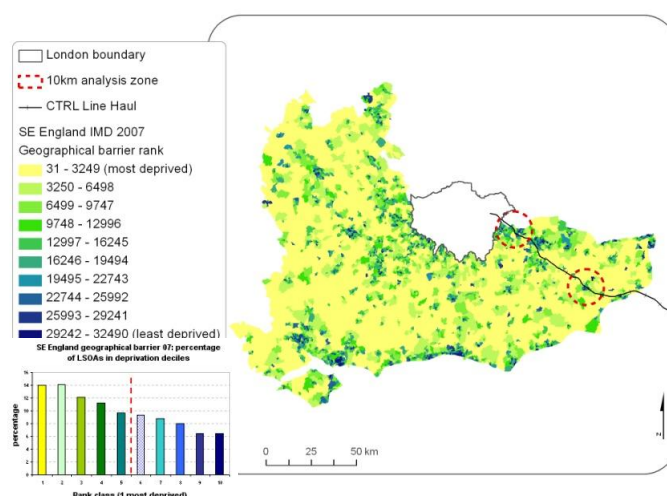


Fig. 10.11: SE England GOR: Geographical Barrier sub-domain 2007 [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

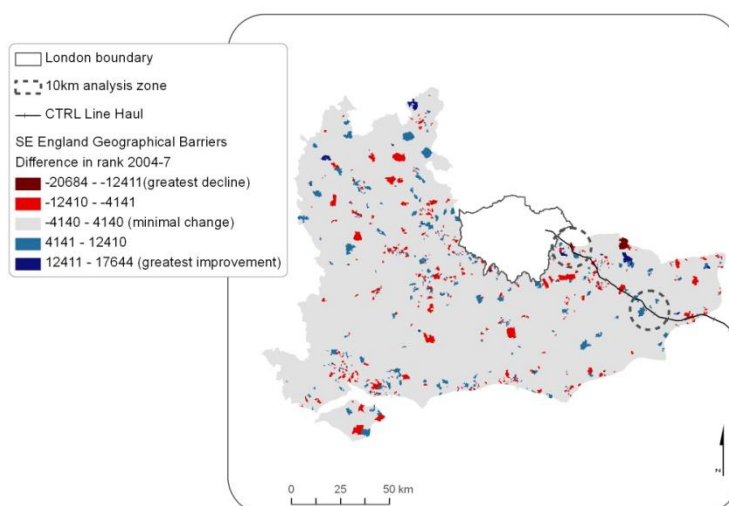


Fig. 10.12: SE England GOR: Geographical Barrier sub-domain rank change 2004-7 [CDRC 2001 OAC Geodata Pack by the ESRC Consumer Data Research Centre; National Statistics data Crown copyright/database right 2003; Ordnance Survey data Crown copyright/database right 2003]

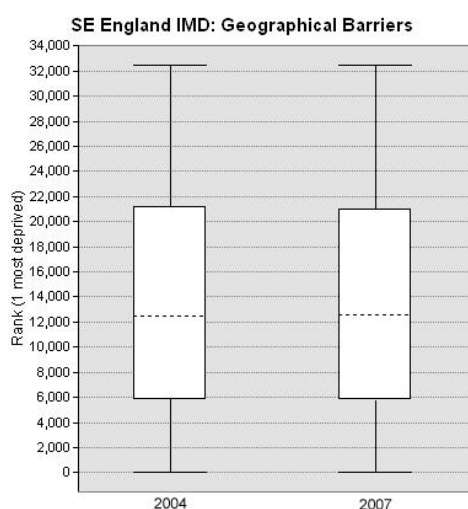


Fig. 10.13: Box plot for the Geographical Barrier sub-domain: SE England GOR

The box plot for the Geographical Barrier sub-domain in SE England (fig. 10.13 above) indicates that the majority of the region is not very well connected to key resources although there are extreme high and low ranking LSOAs located in the area. The median for the two indices remain approximately the same; 12,512th in 2004 and 12,577th in 2007, but there is a slight skew in the inter-quartile values towards greater deprivation for both time periods. The small bar charts accompanying the maps clearly clarify that the majority of the dispersion of LSOAs is in the more deprived deciles, both datasets with a very similar proportion in each class.

10.6

Appendix:

Modification of the SuperSegment classes

Adoption of the Steer Davies Gleave (SDG) TNI used in the Ashford accessibility indicator was problematic in the initial format as several of the derived Travel SuperSegments contained the same OAC groups, causing a significant overlap of geographical distribution for some of the classes:

The areas that are hatched (figs. 10.14-10.16) illustrate a where the OAC group is in both SuperSegment classes, and in some cases the same OAC group was allocated to classes that have high vs. low transport needs:

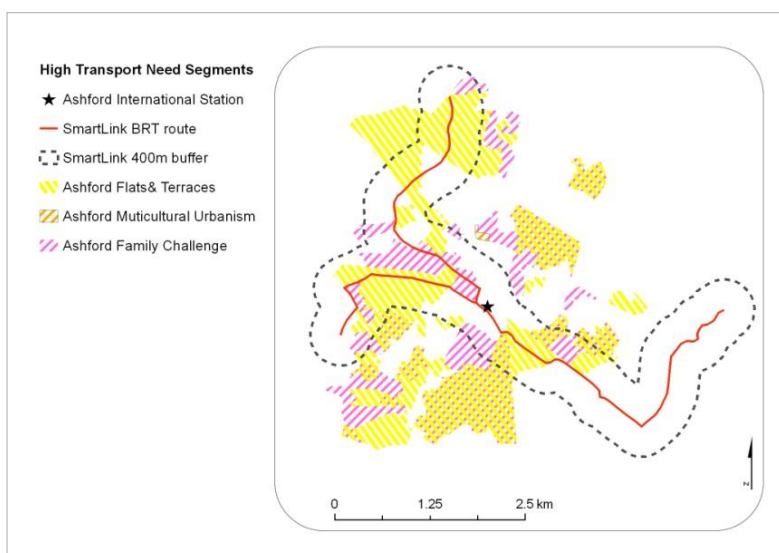


Fig. 10.14: Overlap of TNI classes: example 1 [Duckenfield 2009, 2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

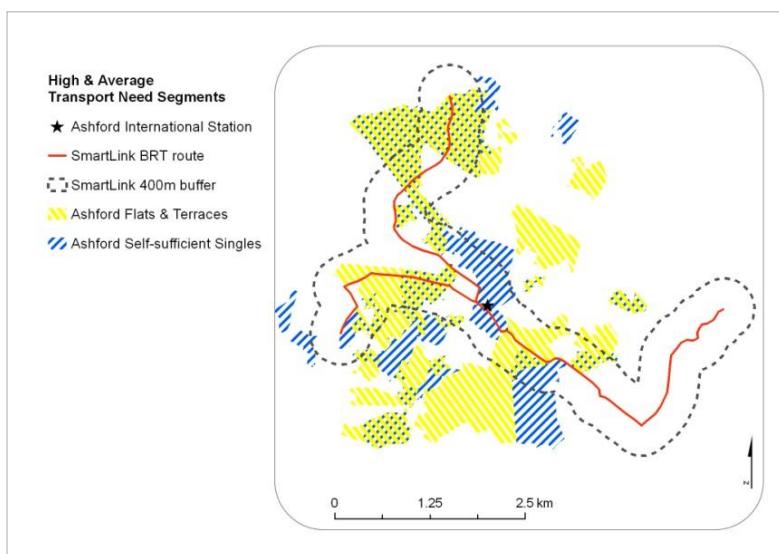


Fig. 10.15: Overlap of TNI classes: example 2 [Duckenfield 2009, 2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

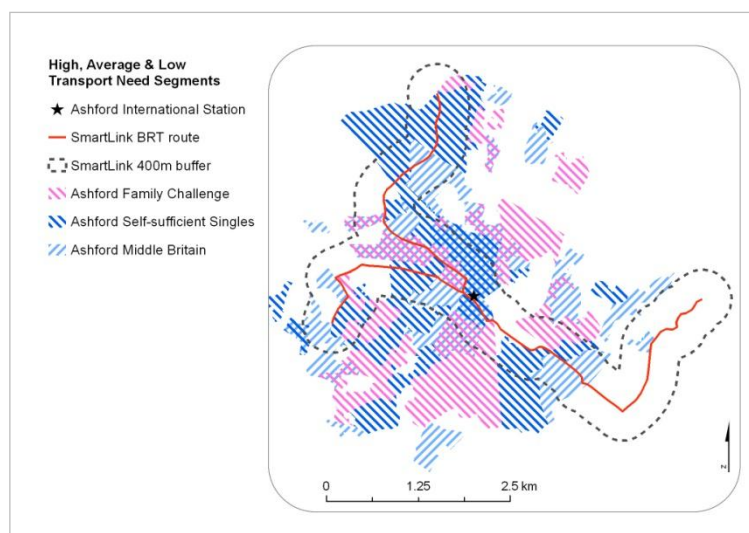


Fig. 10.16: Overlap of TNI classes: example 3 [Duckenfield 2009, 2001 Census, Output Area Boundaries. ©Crown copyright 2003 / UK Borders]

The classes as originally clustered by Steer Davies Gleave are as follows:

Label	Transport Needs Index	OAC groups	Key tendencies
Flats & terraces	183	1a,5a,5b	Unskilled job, unemployed, retired, poor health
Multi-cultural urbanism	171	7a,7b	Town, city centre location, non-white ethnicity
Family challenge	157	1a,1b,6c	Lower paid occupation, children in household
Self-sufficient singles	88	1c,2a,2,5b	Single or couple, working age, lower income
Middle Britain	60	2b,6a,6b,6c,7a	1 or 2 cars, children, semi-detached
Country life	38	3a,3b,3c	Rural location, 2+ cars
Prosperous professionals	27	4a,4b,4c,4d,6d	High income, 2+cars, detached house

Fig. 10.17: The original SuperSegment classes. From Duckenfield (2009:6)
[reproduced with permission [email Feb 2012]

With the following amendments for this research so that each class is mutually exclusive:

Class	Transport Needs Index		OAC groups	Key tendencies
Flats & Terraces	183	Very High	5a 5b 5c	unskilled work, unemployed, retired, poor health
Multi-cultural urbanism	171	High	7a 7b	town, city centre location, non-white ethnicity
Family challenge	157	High	1a 1b 6c	lower paid occupation, children in household
Self-sufficient singles	88	Average	1c 2a 2b	single or couple, working age, lower income
Middle Britain	60	Low	6a 6b	1 or 2 cars, children, semi-detached
Country life	38	Low	3a 3b 3c	rural location, 2+ cars
Prosperous professionals	27	Very Low	4a 4b 4c 4d 6d	high income, 2+ cars, detached housing

Fig. 10.18: The modified SuperSegment classes

Four classes remain the same; Multi-cultural urbanism, Family challenge, Country life and Prosperous professionals, the remainder underwent the following adjustments following close consultation of the OAC metadata (O.N.S. 2009)

Flats & Terraces: Group 1a was allocated to Family challenge as although it was above national average for Terraces, it was below national average for Flats, and slightly above average for Dependant Children and Transport to Work. Also group 5c is absent from their analysis but in their report, SDG imply that this group which is high in Lone Parents and on their scattergraph (fig. 7.66) implying an un-met high need for transportation. It has therefore been including within this class of high transport need.

Self-Sufficient singles: Group 5b was removed from this class and allocated to Flats and Terraces as it was above national average for All Flats and around average for Non-Dependant Children.

Middle Britain: this class was greatly diminished as both 2b (allocated to Self-sufficient singles) and 7a (allocated to Multi-cultural urbanism – although not present in Ashford 3km analysis zone) were both very high above average for All Flats, and this Travel SuperSegment class is typified by semi-detached housing. Group 6c was harder to allocate as it was average for Dependant Children and HE Qualifications, but was finally placed in Family Challenge, as it was higher than national average for Terraced Housing.

The end result is less diversity in the SuperSegment classes with only OAC Groups 1 and 6 split.

10.7

Appendix:

Ashford bus network map



Fig. 10.19: Ashford bus network map (© April 2010)

[www.stagescoachbus.com/uploads/AshfordNetworkMap%5B2%5D.pdf]

10.8

Appendix:

The Accessibility indicator

Recreational Employment Opportunities (A^{RC}_i)

This type of employment opportunity is dominated by pubs and restaurants, and a range of different sporting activities such as gymnasiums and health centres with hotels and clubs in smaller numbers. This type of employment opportunity is potentially of interest to all of the demographic groups along the bus route.

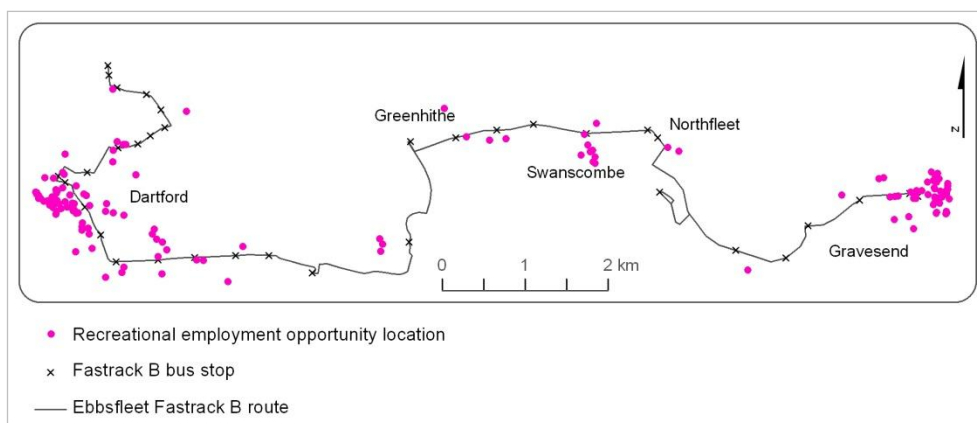


Fig. 10.20: Location of recreational employment opportunities along the Fastrack route B. [Mastermap2 ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

There is a moderately greater dispersal of employment opportunities south of Dartford of recreational employment locations (fig. 10.20), which leads to a slight variation on previous relatively improved accessibility levels:

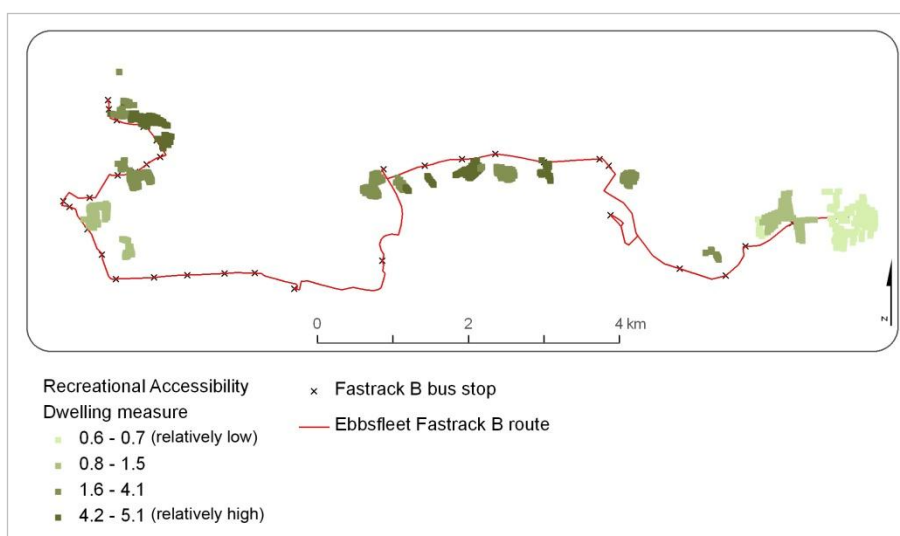


Fig. 10.21: Dwelling measures of accessibility to recreational employment opportunities [Mastermap2 ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Here Swanscombe has the highest accessibility improvement (fig. 10.21), followed by northern Dartford. Gravesend improves the least as the number of recreational opportunities beyond the town centre and within the bus travel time limits are very sparse.

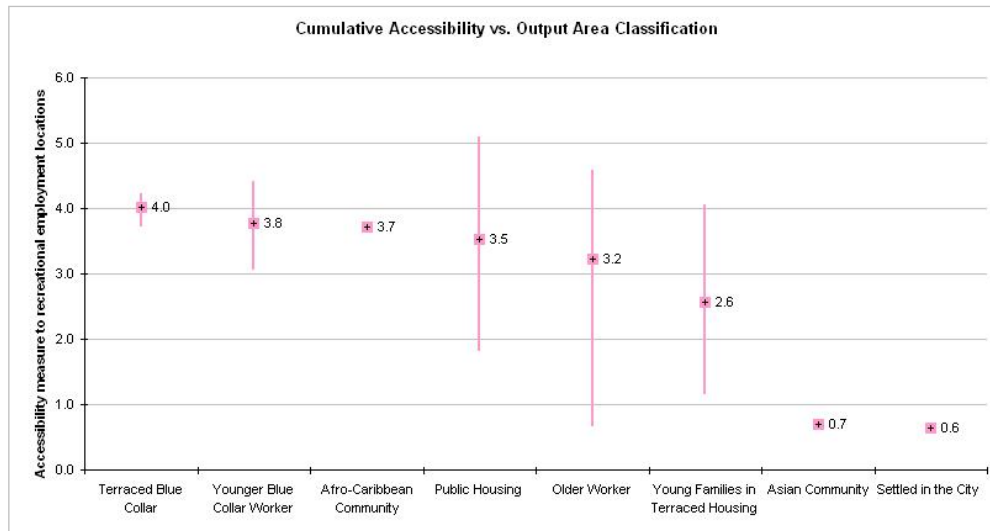


Fig. 10.22: Accessibility measures for the Output Area Classifications: recreational opportunities (full range & mean)

For this employment opportunity, both Terraced and Younger Blue Collar Worker OA classification dwellings have the highest average accessibility measures, whilst Public Housing and Older Worker classes have some higher values (fig. 10.22 above). Older Worker has an atypically low mean accessibility measure with this opportunity type over other types due to the skew of recreational employment locations to the western side of the route. Within walking distance to Gravesend town centre, it is not surprising that Asian Community and Settled in the City classed dwellings have the least improvement to their relative accessibility via the new bus service to these employment opportunities.

Retail employment opportunities (A^{RT}_i)

This employment type is vastly dominated by 'general commercial' local shops (which in reality represent very limited employment opportunities), followed by 'shopping' with smaller numbers of supermarkets, garden centres and department stores. Unlike the other employment opportunities, retail locations often have more than one 'opportunity' allocated to the same spatial point on the map. The most notable example of this is Bluewater shopping centre, which has 84 retail employment opportunities linked to a single point. The map below (fig. 10.23) illustrates the distribution of multiple opportunities.

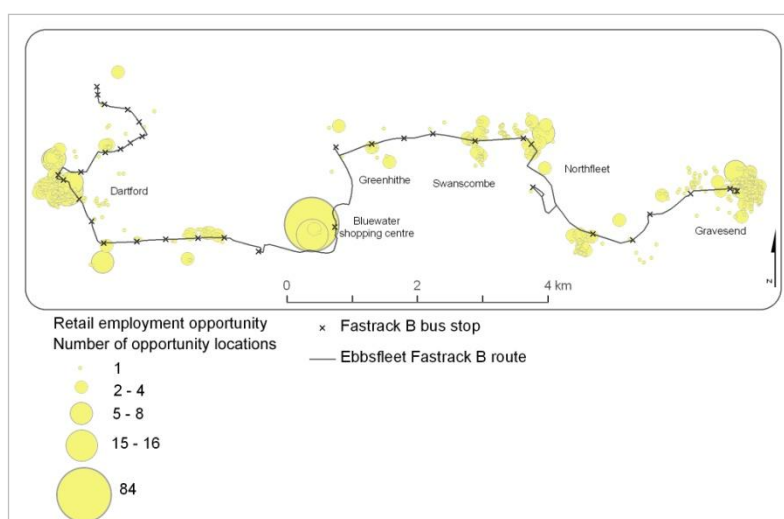


Fig. 10.23: Multiple retail employment opportunities per spatial location on Fastrack route B [Mastermap2 ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

As this increased level of employment opportunities is spatially very concentrated, there is not much differentiation on the underlying accessibility trend, as this measure does not account for multiple opportunities at a location, only the accessibility to that location. This is reflected in the accessibility map below (fig. 10.24). Of note, despite their proximity in walking distance to Bluewater, Greenhithe and Swanscombe still have the highest increased accessibility regardless, and again northern Dartford benefits but to a lesser extent.

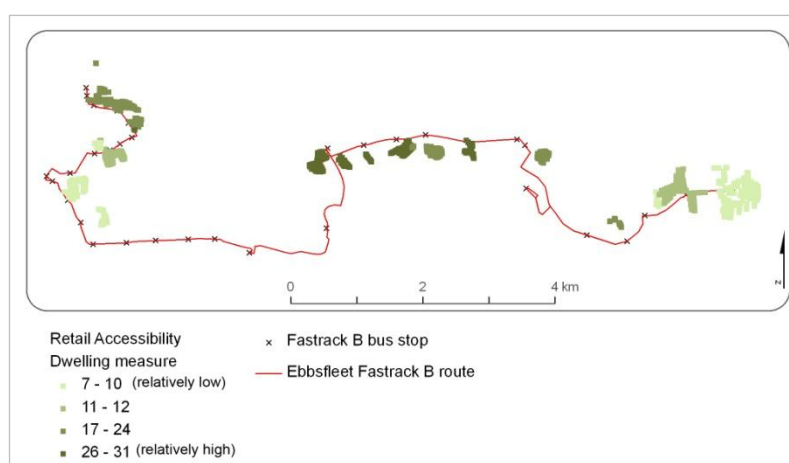


Fig. 10.24: Dwelling measures of accessibility to retail employment opportunities [Mastermap2 ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

Aside from the greater outliers for Younger Families in Terraced Housing (fig. 10.25), the ranking for the OA classifications matches that of the cumulative measure, with essentially no deviation despite a much higher number of opportunity locations.

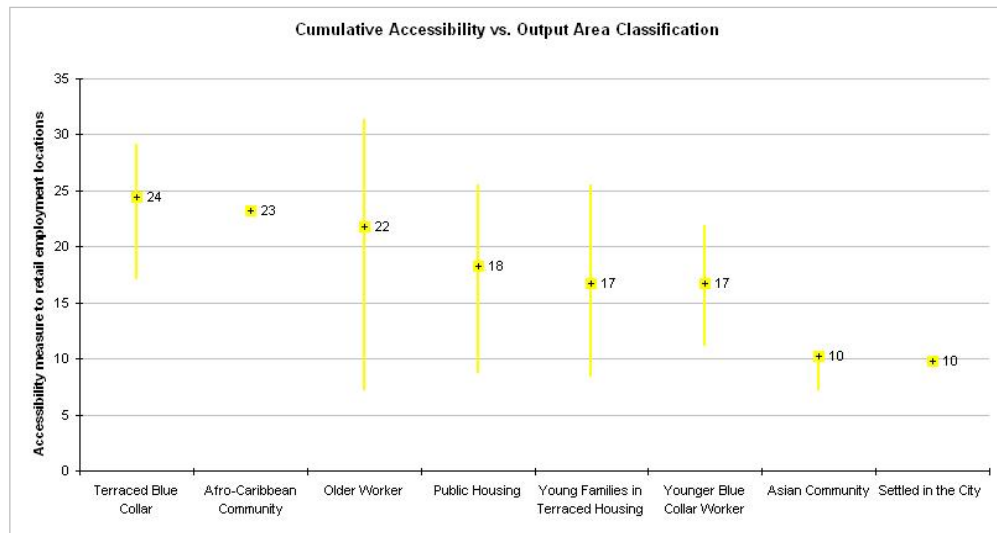


Fig. 10.25: Accessibility measures for the Output Area Classifications: retail opportunities (full range & mean)

10.9

Appendix:

Accessibility to Ebbsfleet International station

The accessibility measures in chapter 7.3 are primarily concerned with changes in relative accessibility for non-users of the MUP, but a brief look at the OD matrix for the train station along route B indicates that high unemployment dwellings in Gravesend, Northfleet, Swanscombe and Greenhithe as well as the most southern dwellings of Dartford can reach the station in under 40 minutes walk-bus travel time (figs. 10.26 and 10.27)

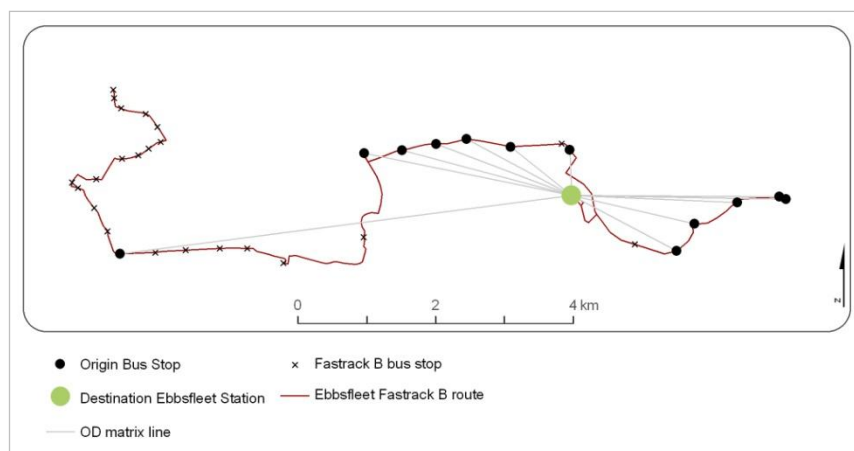


Fig. 10.26: OD matrix along Fastrack route B to Ebbsfleet train station

As there is a single destination, the 'accessibility measure' is simply the cumulative time travel taken as a simple visualisation tool. It is interesting to note that almost all of Dartford urban area is beyond the 40 minute travel time via the Fastrack bus route, although Dartford is connected via Arriva Trains to London, hence is not dependent on the feeder bus to access rail links to London

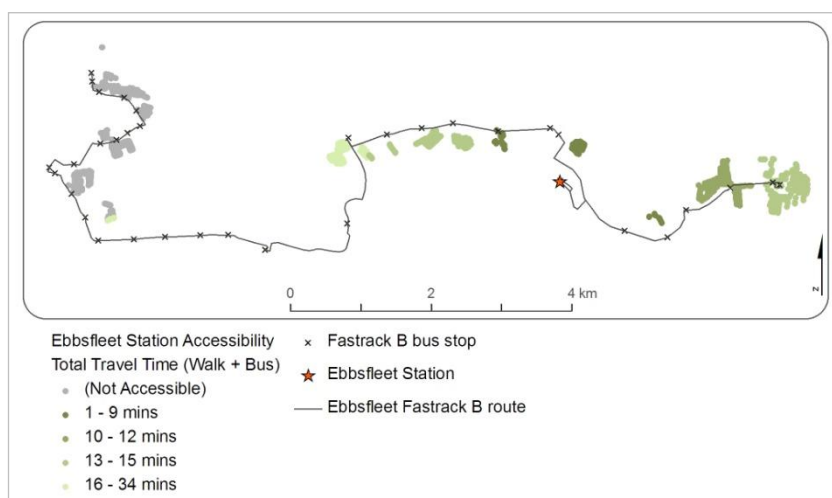


Fig. 10.27: Travel times from high unemployment dwellings to Ebbsfleet Station [Mastermap2 ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

10.10

Appendix:

Ebbsfleet Valley masterplan



Fig. 10.28a, b and c: Eastern Quarry Masterplan zones

[© ebbsfleetvalley.co.uk – accessed Feb. 2010]

10.11

Appendix:

The Physical Barriers indicator

The Impeded Access sub-indicator

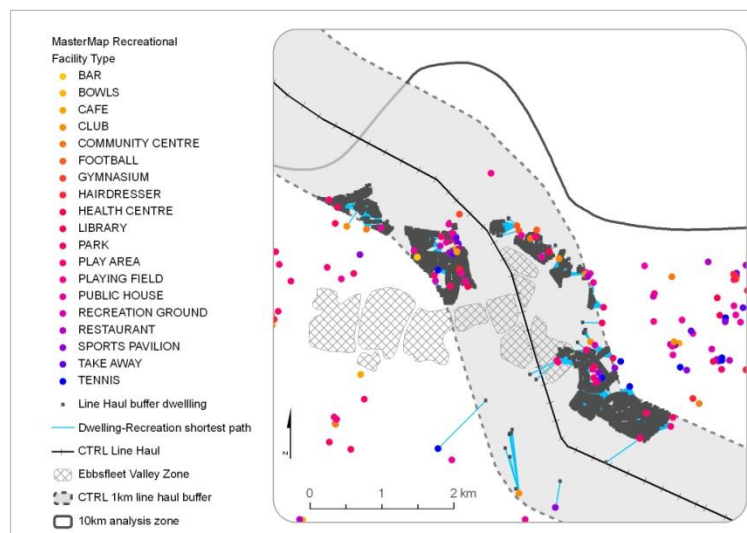
Recreational facilities

Fig. 10.29: Ebbsfleet line haul dwellings and nearest neighbour paths to recreational facilities [Mastermap2 ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

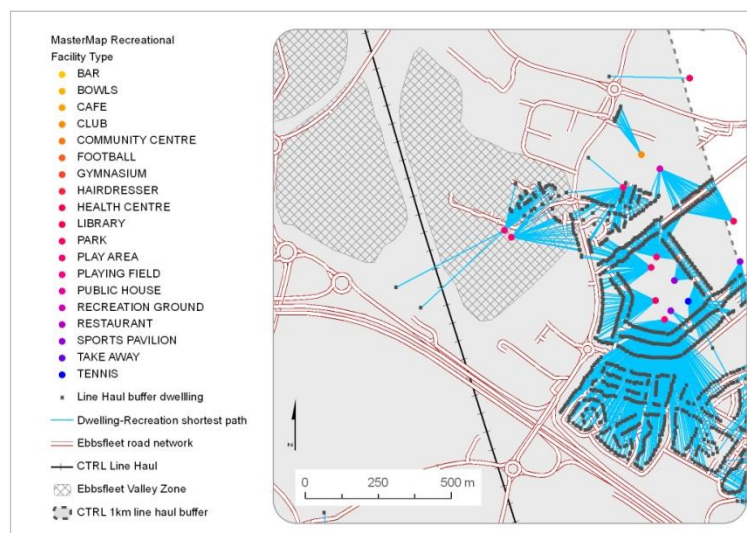


Fig. 10.30: Ebbsfleet line haul dwellings and close up of nearest neighbour paths to recreational facilities [Mastermap2 ©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

The overall spatial distribution of recreational facilities (above fig. 10.29) is evenly spread amongst the most densely occupied areas, with some variation as to the location of some. For example a sporting facilities that may require open ground and are less likely to be highly accessible than a public house for example. Nonetheless, the mean distance of the nearest

neighbour path is 173m between dwelling and facility (min:3m, max:941m, 1 Std. Dev.:21.5m). The residents of the line haul buffer dwellings are able to reach their nearest 'recreational' facility without the need to cross the line haul except for two dwellings located south of the Ebbsfleet Valley development, seen in fig. 10.30 (above). In this example the nearest neighbour path is drawn to a park and a play area, which the dwelling's occupants would require a significant round trip by car to use. Given the location of these dwellings, it is clear to see that they have low accessibility to all of the recreational facilities present in the community (southern Gravesend) across the railway line, with no nearer facilities on the same side.

Retail facilities:

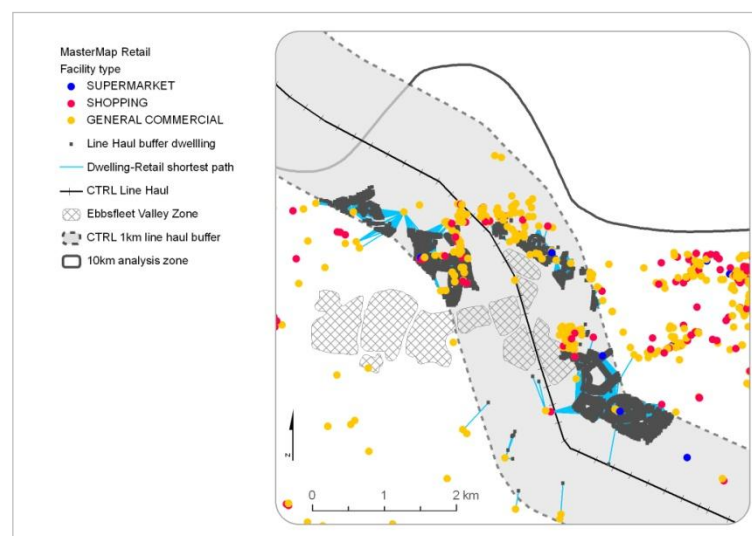


Fig. 10.31: Ebbsfleet line haul dwellings and nearest neighbour paths to retail facilities

The retail facilities are the most narrowly defined subset, containing only supermarkets, shopping and 'general commercial' (which appears to be the ubiquitous 'corner shop'). There are a great many 'general commercial' locations, much less 'shopping' and few supermarkets. The map above (fig. 10.31) illustrates that the vast majority of the dwellings are able to reach their nearest retail facility (mean path distance is 170m, min:3m, max:749m, 1 Std. Dev.:115m) without crossing the railway, although 26 dwellings have their nearest shopping location across the line haul (see fig. 10.32 below). However they are well connected to the road network including an overpass and hence the railway line is not a significant hindrance.

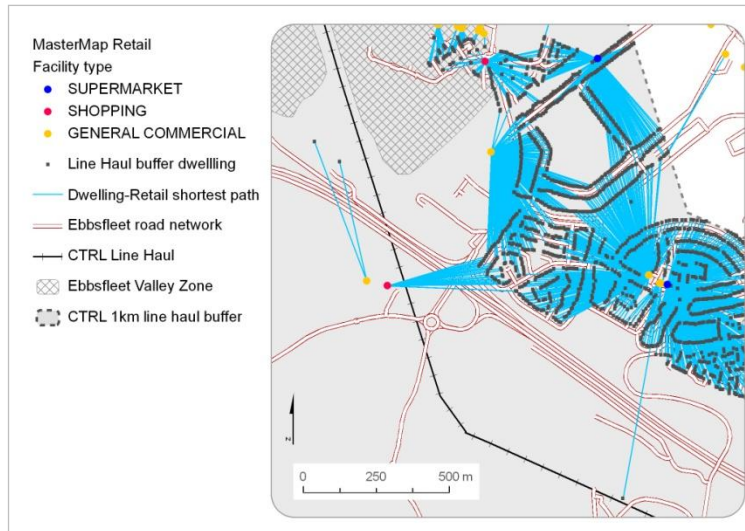


Fig. 10.32: Ebbsfleet line haul dwellings and close up of nearest neighbour paths to retail facilities [Mastermap2
©Crown copyright/database right 2011 Ordnance Survey/EDINA Digimap]

10.12

Appendix:

Origin-Destination workplace flows

Ashford least deprived wards (not included in chapter 7.5b)

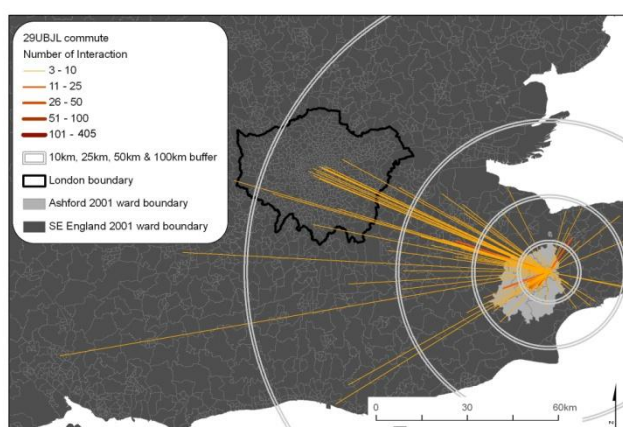
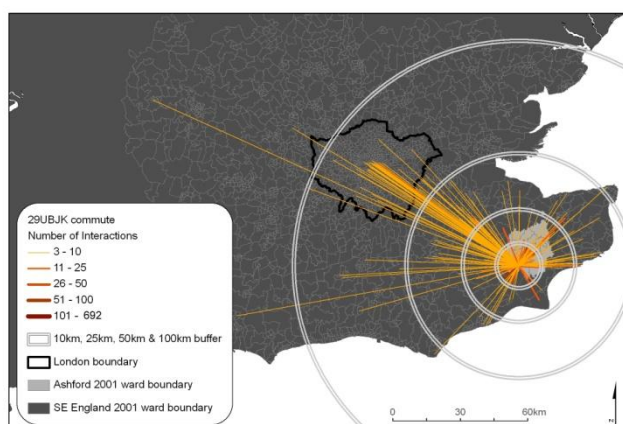
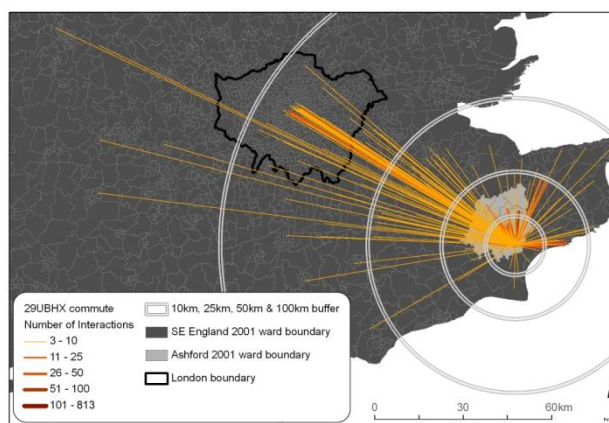


fig 10.33: Ashford least deprived 29UBHX, fig. 10.34: Ashford least deprived 29UBKJ,
fig 10.35: Ashford least deprived 29UBJL [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown
copyright/database right 2011 Ordnance Survey/EDINA]

Ashford most deprived wards (not included in chapter 7.5b)

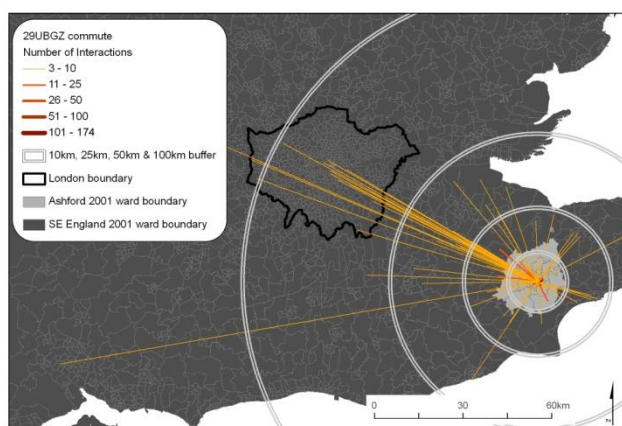


Fig. 10.36: Ashford most deprived 29UBGZ [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

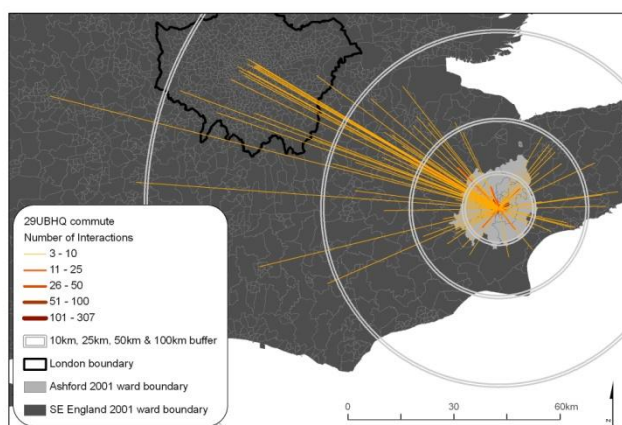


Fig. 10.37: Ashford most deprived 29UBHQ [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

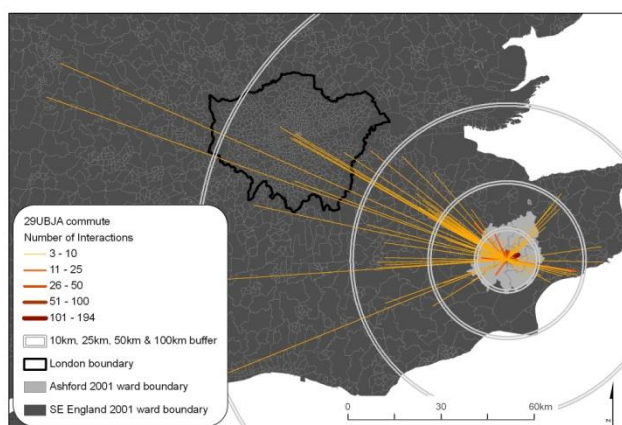


Fig. 10.38 Ashford most deprived 29UBJA [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

Ebbfleet least deprived wards (not included in chapter 7.5b)

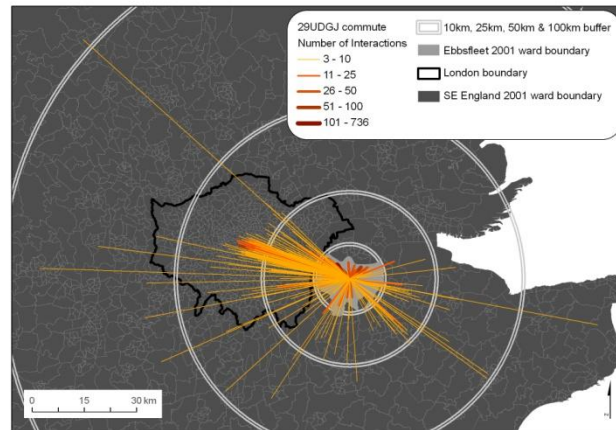


Fig. 10.39: Ebbfleet least deprived 29UDGJ [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

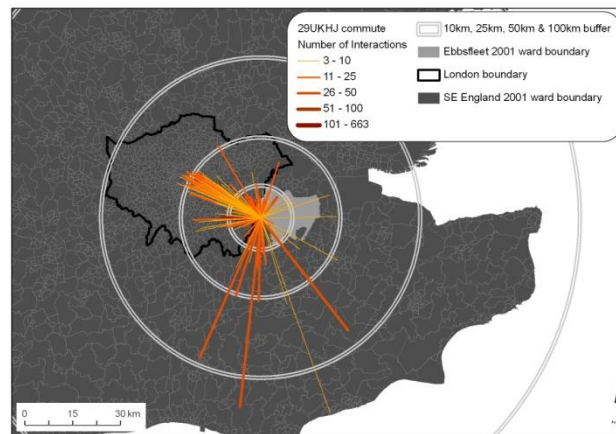


Fig. 10.40: Ebbfleet least deprived 29UKHJ [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

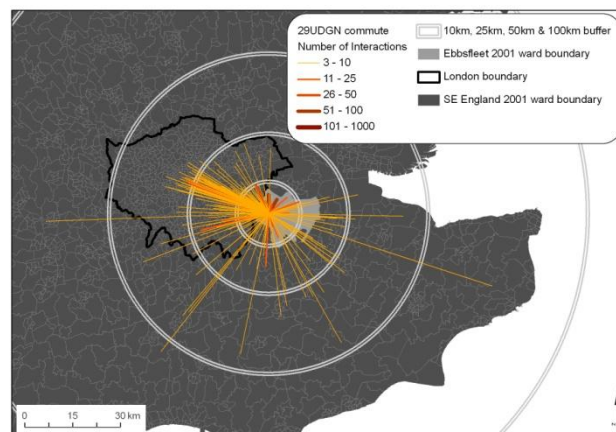


Fig. 10.41: Ebbfleet least deprived 29UDGN [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

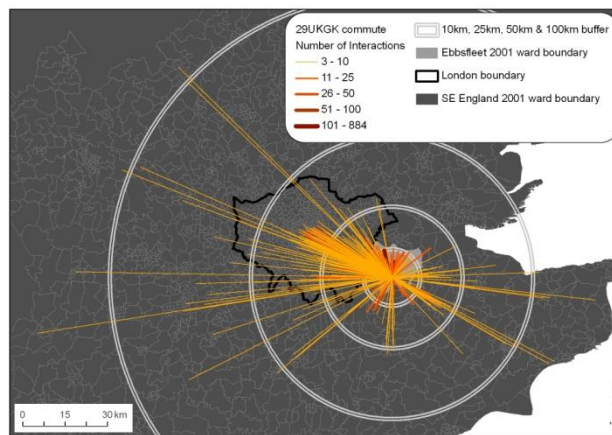


Fig. 10.42: Ebbsfleet least deprived 29UKGK [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

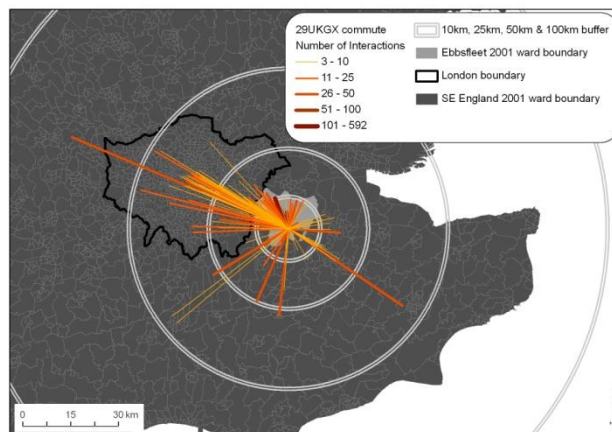


Fig. 10.43: Ebbsfleet least deprived 29UKGX [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

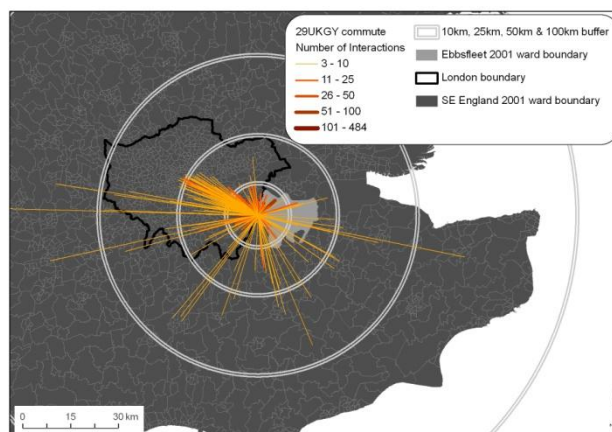


Fig. 10.44: Ebbsfleet least deprived 29UKGY [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

Ebbfleet most deprived wards (not included in chapter 7.5b)

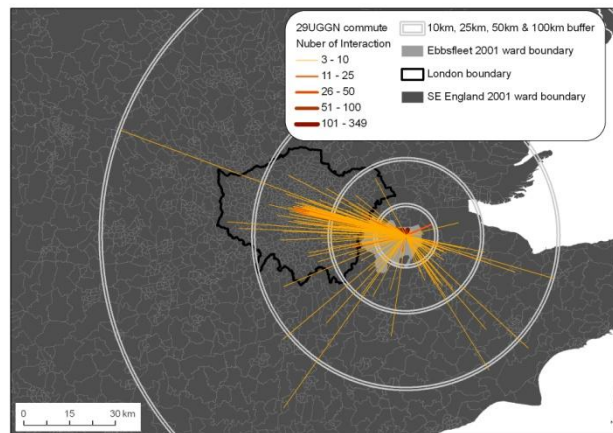


Fig. 10.45: Ebbfleet most deprived 29UGGN [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

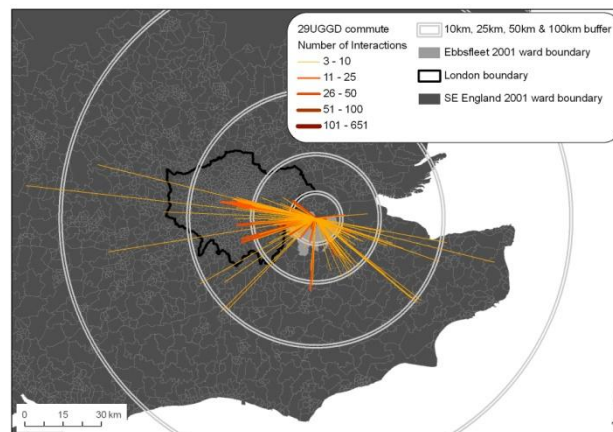


Fig. 1-.46: Ebbfleet most deprived 29UGGD [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

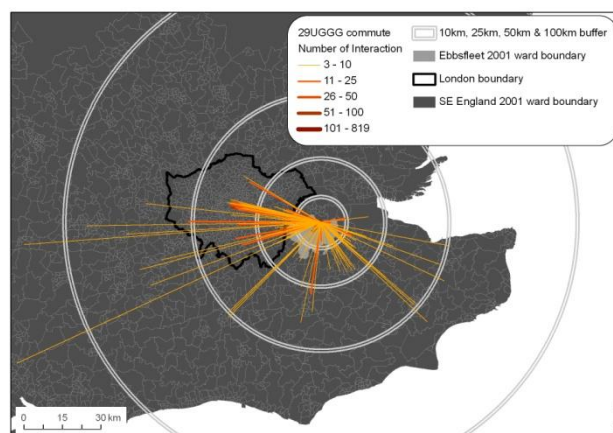


Fig 10.47: Ebbfleet most deprived 29UGGG [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

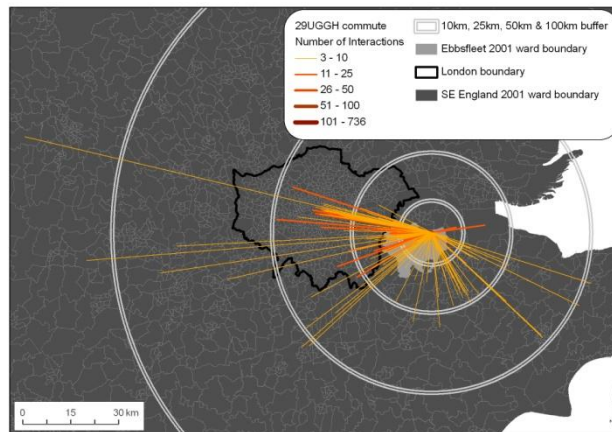


Fig. 10.48: Ebbsfleet most deprived 29UGGH [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

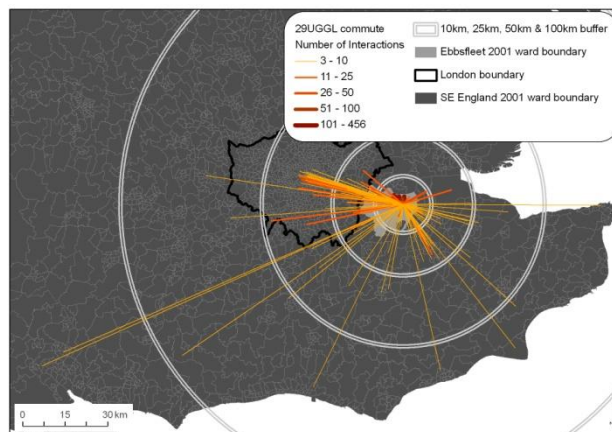


Fig. 10.49: Ebbsfleet most deprived 29UGGL [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

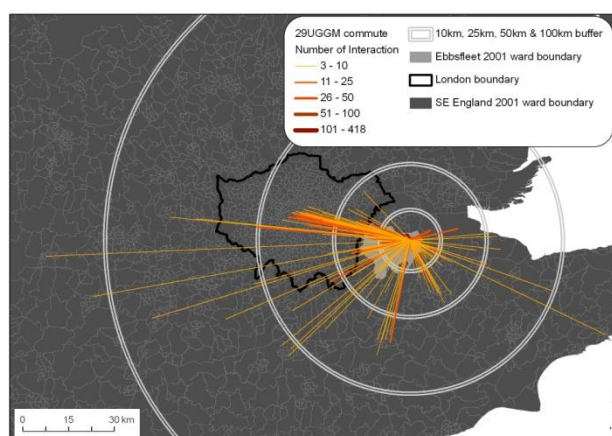
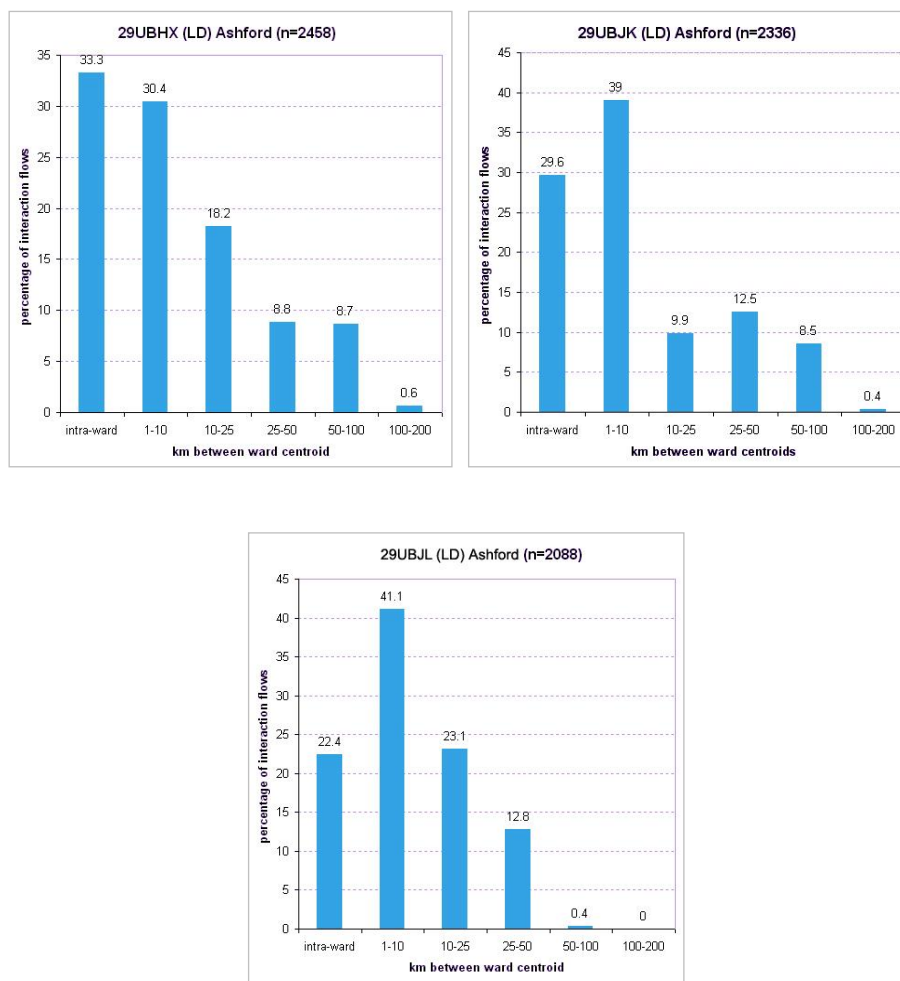


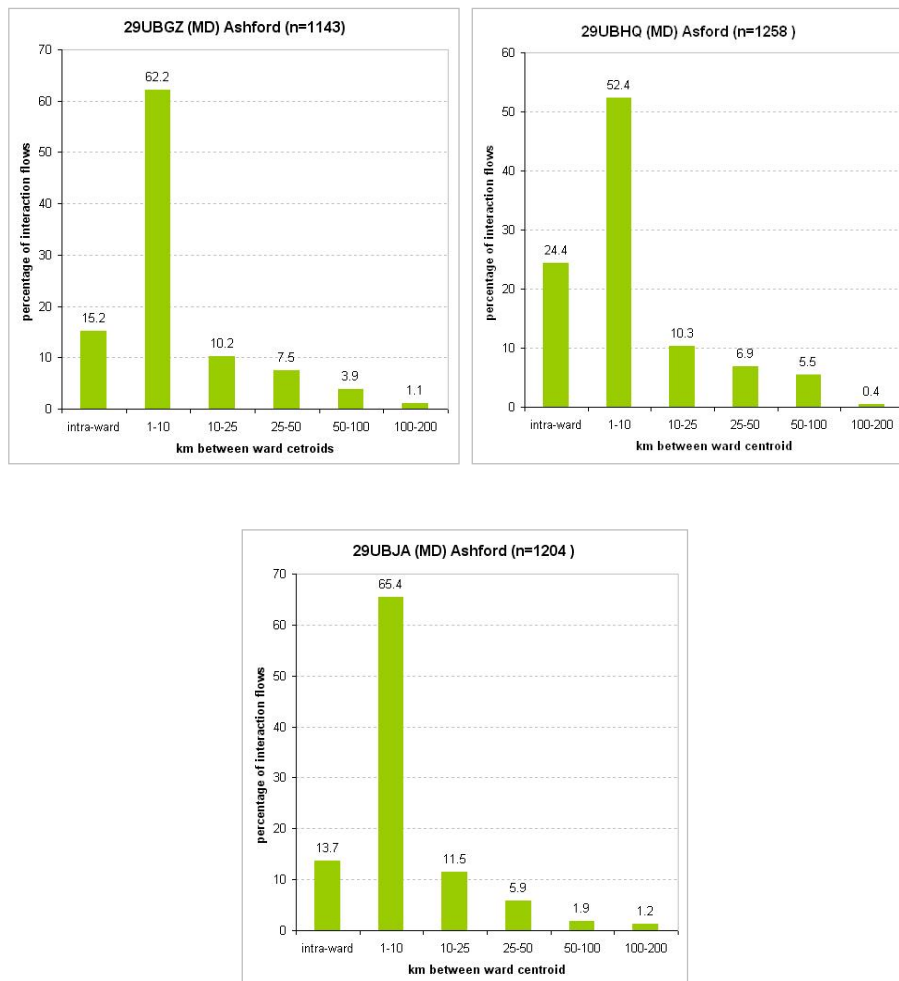
Fig. 10.50: Ebbsfleet most deprived 29UGGM [2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

Ashford least deprived wards (not included in chapter 7.5b)



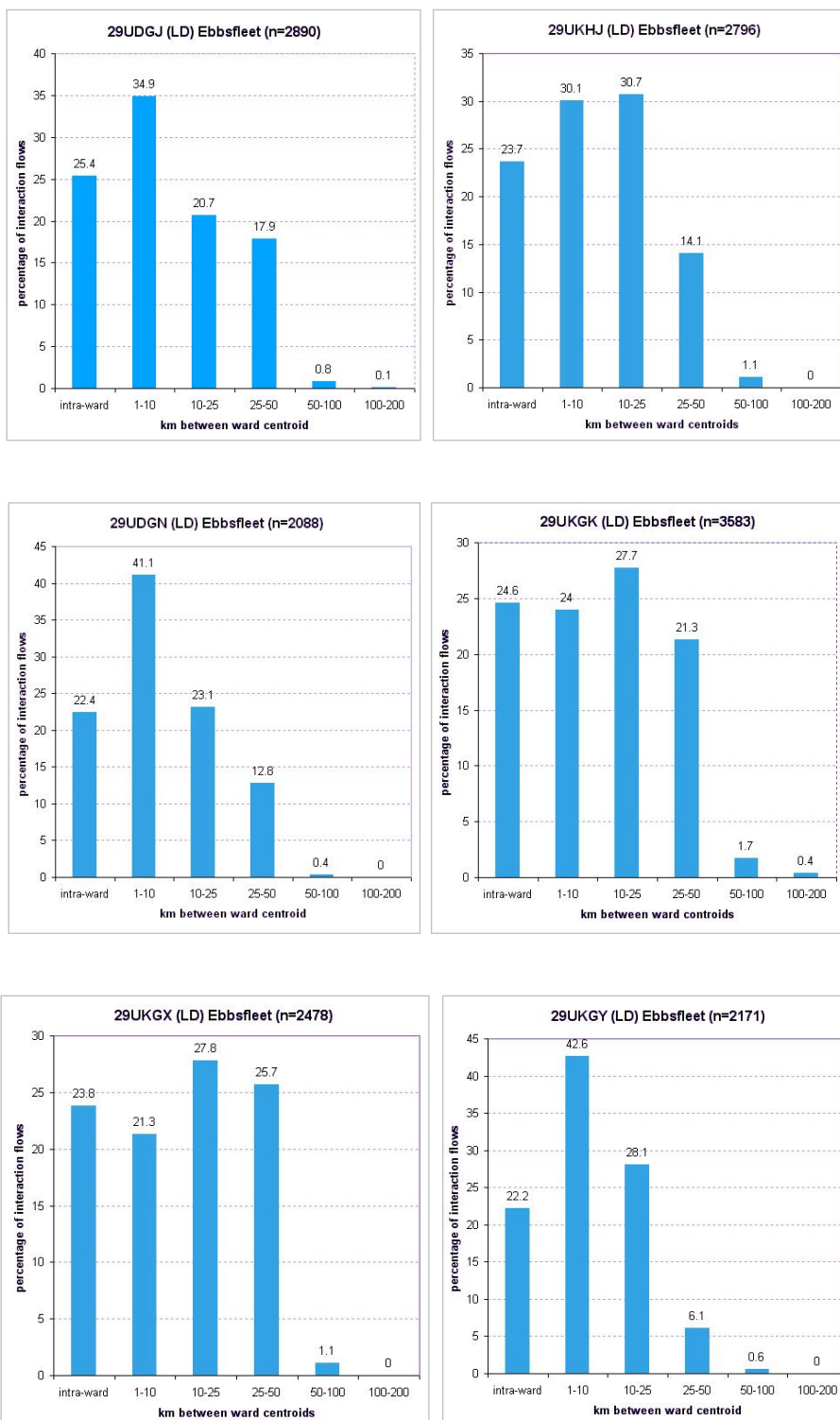
Figs. 10.51-10.53: proportions of distances classes: Ashford least deprived

Ashford most deprived wards (not included in chapter 7.5b)



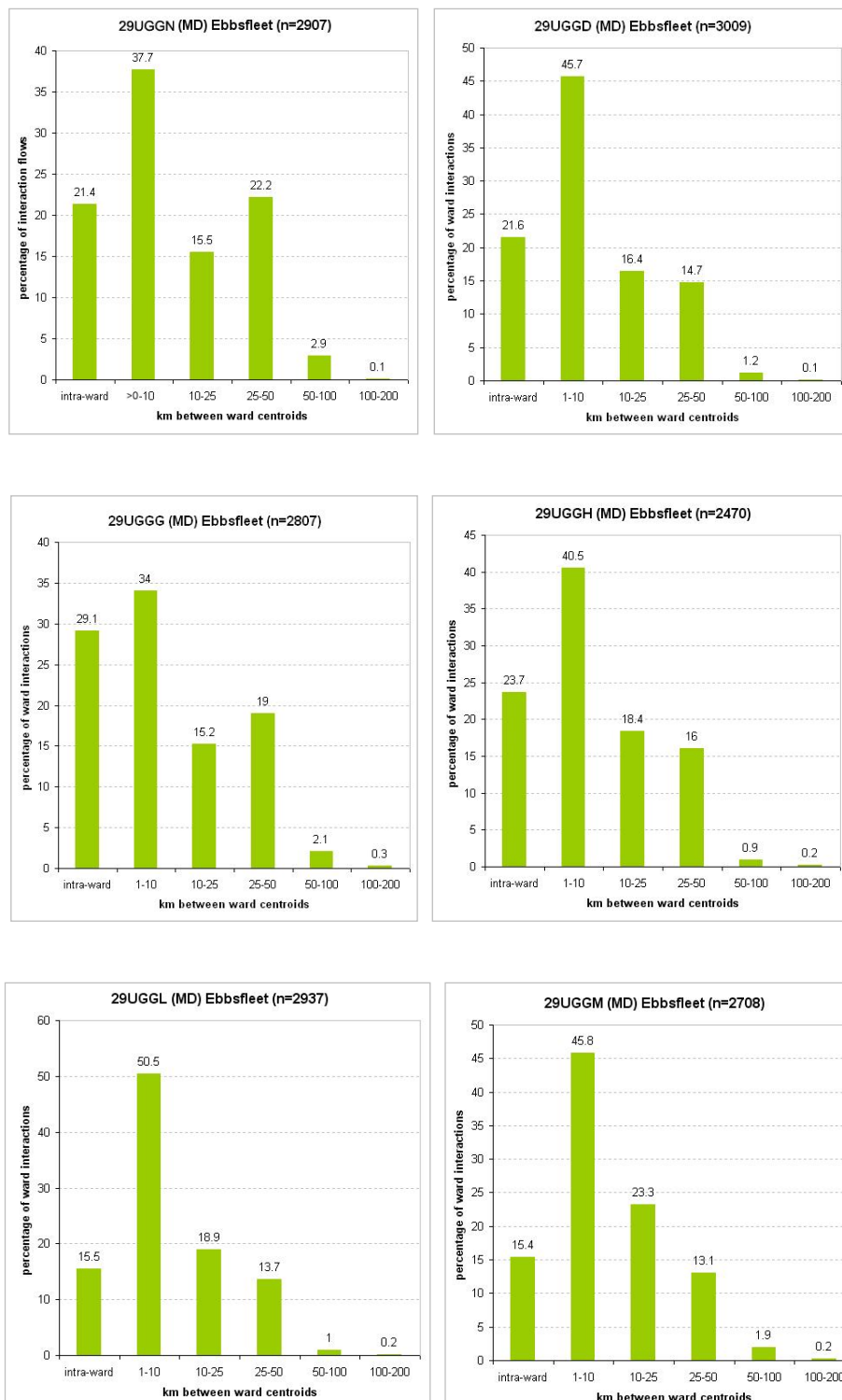
Figs. 10.54-56: proportions of distances classes: Ashford most deprived

Ebbsfleet least deprived wards (not included in chapter 7.5b)



Figs. 10.57-10.62: proportions of distances classes: Ebbsfleet least deprived

Ebbsfleet most deprived wards (not included in chapter 7.5b)



Figs. 10.63-68: proportions of distances classes: Ebbsfleet least deprived

10.13

Appendix:

OD workplace flows over Google map

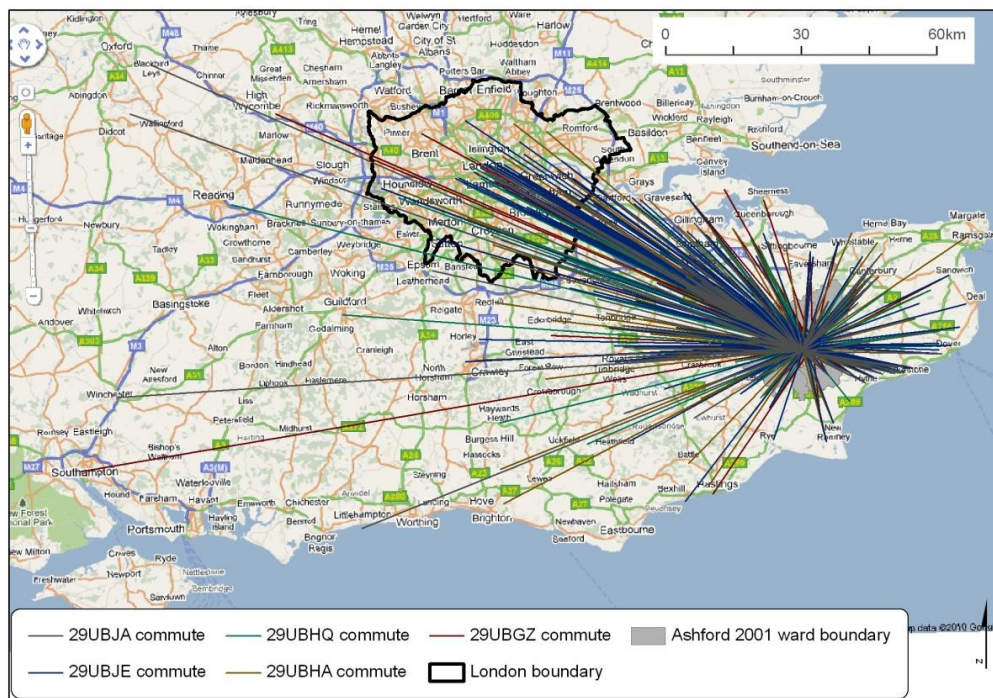
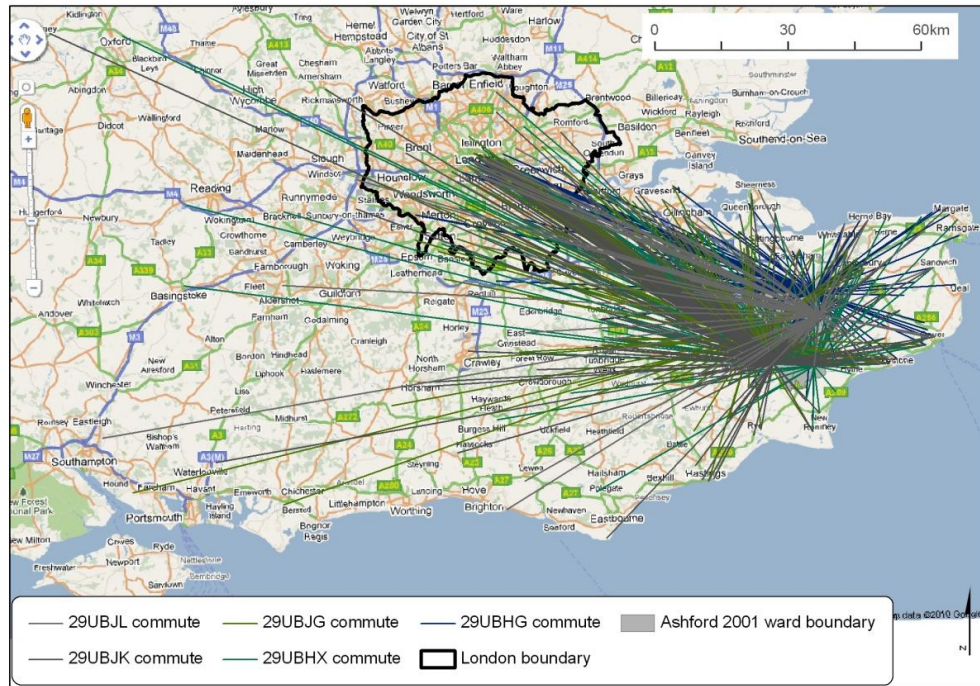


Fig. 10.69: Ashford least deprived wards: OD workplace flows & Fig. 10.70: Ashford most deprived wards: OD workplace flows [© Google Maps 2009, 2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

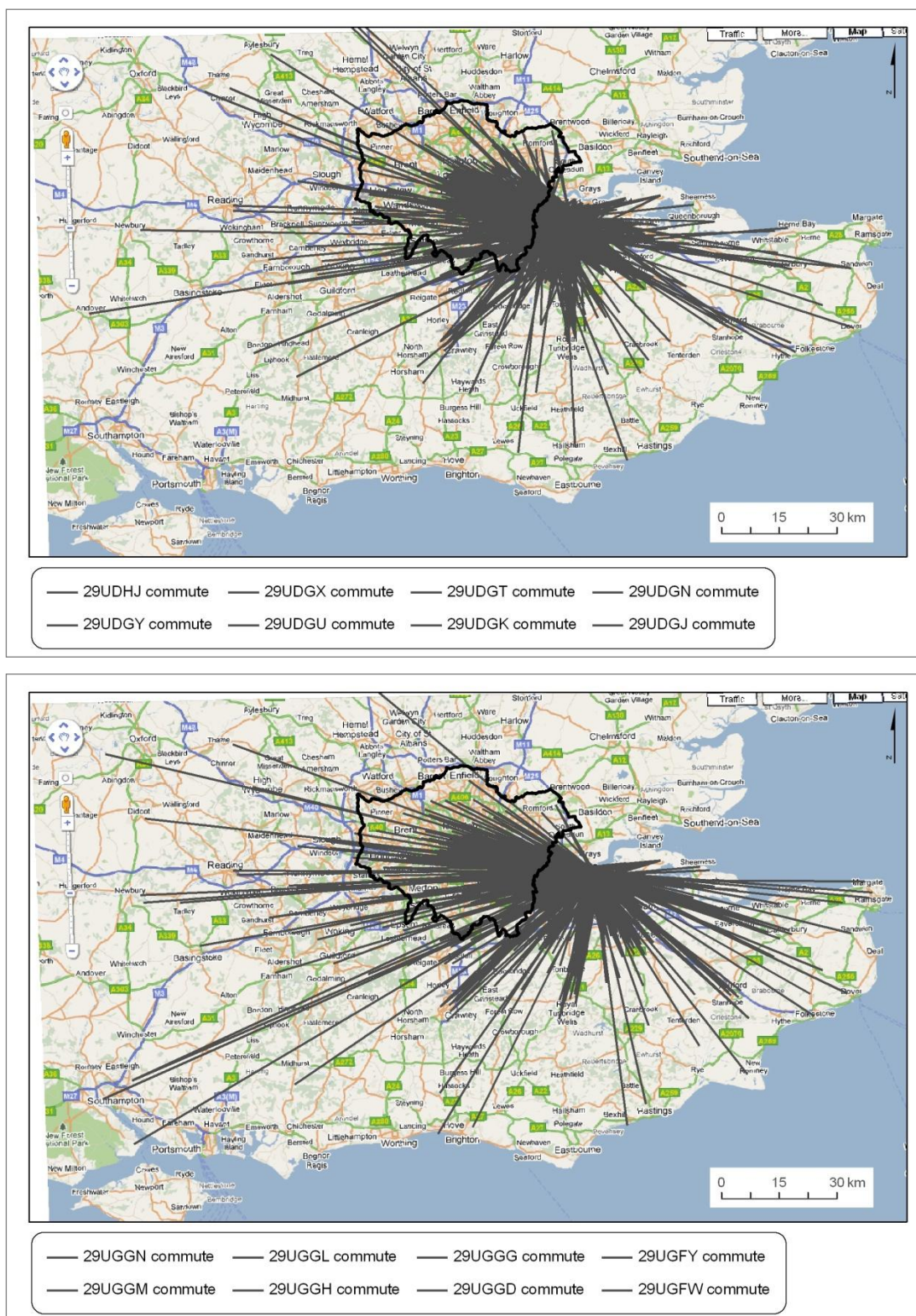


Fig. 10.71: Ebbsfleet least deprived wards: OD workplace flows & Fig. 10.72: Ebbsfleet most deprived wards: OD workplace flows [© Google Maps 2009, 2001 Census, Special Workplace Statistics C.I.D.E.R & ©Crown copyright/database right 2011 Ordnance Survey/EDINA]

10.14

Appendix:

Calculations: Kolmogorov-Smirnov test for significance

Ashford KS test: significance between most and least deprived wards in the distance travelled to work

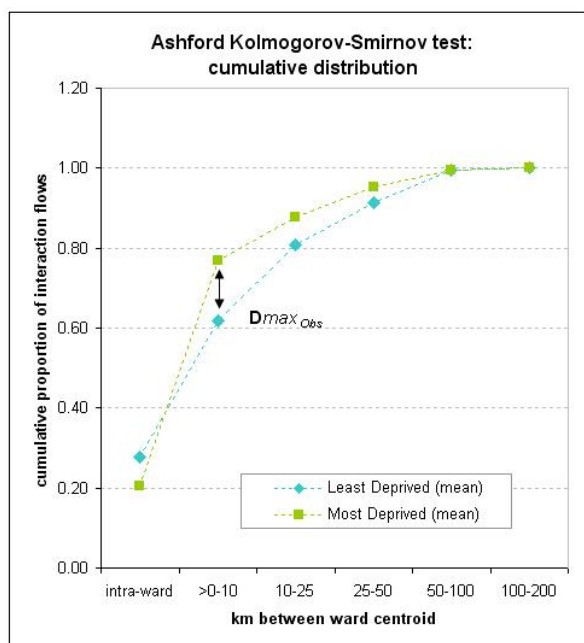
	Least Deprived (mean)	Most Deprived (mean)	Least Deprived (cuml proportion)	Most Deprived (cuml proportion)	Difference
intra-ward	27.76	20.6	0.28	0.21	-0.07
1-10km	34	56.36	0.62	0.77	0.15
10-25km	18.92	10.76	0.81	0.88	0.07
25-50km	10.64	7.47	0.91	0.95	0.04
50-100km	8.24	4.22	1.00	0.99	0.00
100-200km	0.44	0.59	1	1	0

DmaxObs

	Least Deprived (cuml proportion)	Most Deprived (cuml proportion)	Difference
intra-ward	27.76	20.6	7.16
>0-10	61.76	76.96	-15.2
10-25	80.68	87.72	-7.04
25-50	91.32	95.19	-3.87
50-100	99.56	99.41	0.15
100-200	100	100	0

DmaxObs

KS test	
n1: Least Depr sample	1796
n2: Most Depr sample	8545
n1 + n2 = a	10341
n1 x n2 = b	15346820
a / b	0.000674
sqr rt	0.025958
x 1.95 for (α) = 0.001 signif	0.050618



Ebbsfleet KS test: significance between most and least deprived wards in the distance travelled to work

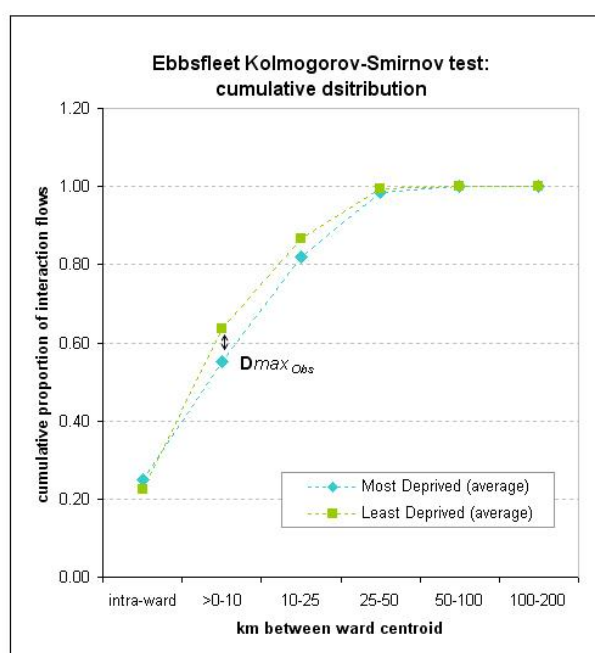
	Least Deprived (average)	Most Deprived (average)	Least Deprived (cuml proportion)	Most Deprived (cuml proportion)	Difference
intra-ward	24.86	22.40	0.25	0.22	-0.02
1-10km	30.37	41.10	0.55	0.64	0.08
10-25km	26.66	23.10	0.82	0.87	0.05
25-50km	16.75	12.80	0.99	0.99	0.01
50-100km	1.30	0.60	1.00	1.00	0.00
100-200km	0.06	0.00	1.00	1.00	0.00

DmaxObs

	Least Deprived (cuml proportion)	Most Deprived (cuml proportion)	Difference
intra-ward	24.8625	22.4	2.4625
>0-10	55.2275	63.5	-8.2725
10-25	81.89	86.6	-4.71
25-50	98.64	99.4	-0.76
50-100	99.94	100	-0.06
100-200	100.0025	100	0.0025

DmaxObs

KS test	
n1: Least Depr sample	2584
n2: Most Depr sample	20828
n1 + n2 = a	23412
n1 x n2 = b	53819552
a / b	0.000435
sqr rt	0.020857
x 1.36 for (α) = 0.05 signif	0.028365



10.15

Appendix:

Calculations for the Deprivation score inputs

Ashford

Ashford	2001 Ward Name	CODE	IMD rank change 2004-07					Geographical Barrier rank change 2004-07					WardScore
			-2	-1	0	1	2	-2	-1	0	1	2	
	Stanhope Ward	29UBJA		1	1					2			2
	Aylesford Green Ward	29UBGZ	1		1				2				0
	Beaver Ward	29UBHA		3		1			1	1	1		0
	Victoria Ward	29UBJE	1	1	1					1			-3
	Norman Ward	29UBHQ			2					1		1	2
	Bockhanger Ward	29UBHC	1	1						1	1		1
	Bybrook Ward	29UBHE	1	1								2	4
	Stour Ward	29UBJB	2		1				1	1		1	1
	Washford Ward	29UBJF			1				1				0
	South Willesborough Ward	29UBHZ	1							1			1
	North Willesborough Ward	29UBHR	1	2					1	1	1		0
	Godinton Ward	29UBHJ		3					1	1		1	0
	Singleton South Ward	29UBHY	1	1					1				-2
	Little Burton Farm Ward	29UBHP			1					1			0
	Highfield Ward	29UBHL			1	1				1	1		1
	Park Farm North Ward	29UBHS			2							1	0
	Park Farm South Ward	29UBHT			1							1	2

Ebbsfleet 2001 Ward Name	IMD rank change 2004-07						WardScore
	-2	-1	0	1	2		
Stone			3	1			1
Castle			1				0
Greenhithe				3			3
Swanscombe		1	1	2			1
Northfleet North		3	1				-3
Pelham		2	1	1			-1
Bean			1	1	2		5
Longfield			1	2	1		4
Istead			2				0
Painters		1	2				-1
Coldharbour	1	3					-5
Northfleet South	1	2	1	1			-3

Geographical Barrier rank change 2004-07						WardScore
-2	-1	0	1	2		
		3		1		2
			1			1
		3				0
		1	3			3
2		2				-4
		4				0
		1	1	2		5
		3	1			1
			1	1		3
		3				0
		3	1			1
	1	4				-1

10.16

Appendix:

Calculations for the Accessibility scores

Ashford

2001 Ward Name	Accessibility SmartLink		
	Low need	Med need	High need
	1	2	3
Aylesford Green			3
Beaver		2	2
Victoria		4	9
Norman			2
Bockhanger			2
Stour		1	
South Willesborough		5	
North Willesborough	1		
Godinton	1	1	3
Singleton South	2	4	
Highfield	3	1	

Score band (equal numbers per band)	
0-12%	1
13-30%	2
31-100%	3

2001 Ward Name	All OAs	SmartLink OA	Percentage	Score band	Needs weighting	Score	Final Score
Aylesford Green	9	3	33	3	3	6	6
Beaver	18	2	11	1	2	3	3.5
Beaver	18	2	11	1	3	4	
Victoria	18	4	22	2	2	4	5
Victoria	18	9	50	3	3	6	
Norman	9	2	22	2	3	5	5
Bockhanger	8	2	25	2	3	5	
Stour	18	1	6	1	2	3	3
South Willesborough	7	5	71	3	2	5	5
North Willesborough	16	1	6	1	1	2	2
Godinton	12	3	25	2	3	5	3.3
Godinton	12	1	8	1	2	3	
Godinton	12	1	8	1	1	2	
Singleton South	9	4	44	3	2	5	4
Singleton South	9	2	22	2	1	3	
Highfield	8	1	13	2	2	4	4
Highfield	8	3	38	3	1	4	

Ebbsfleet

2001 Ward Name	All Dwell	Access Dwell	%	Score band	Weighting	Score	Final Score
Castle: high access	1181	285	24.1	3	3	6	6
Greenhithe: high access	2844	215	7.6	1	3	4	3.5
Greenhithe: med access	2844	6	0.2	1	2	3	
Swanscombe: high access	3221	79	2.5	1	3	4	3.5
Swanscombe: med access	3221	102	3.2	1	2	3	
Northfleet: high access	3283	220	6.7	1	3	4	3
Northfleet: low access	3283	204	6.2	1	1	2	
Pelham: low access	3303	1045	31.6	4	1	5	5

Score band	1-10%	(<1 Std. Dev.)	1
	11-20%	(>1 Std. Dev)	2
	21-31%	(>2 Std. Dev)	3
	32-40%	(>3 Std. Dev)	4

Weighting	high access	+ 3
	medium access	+ 2
	low access	+ 1

10.17

Appendix:

Scatterplot graphs for Ashford wards

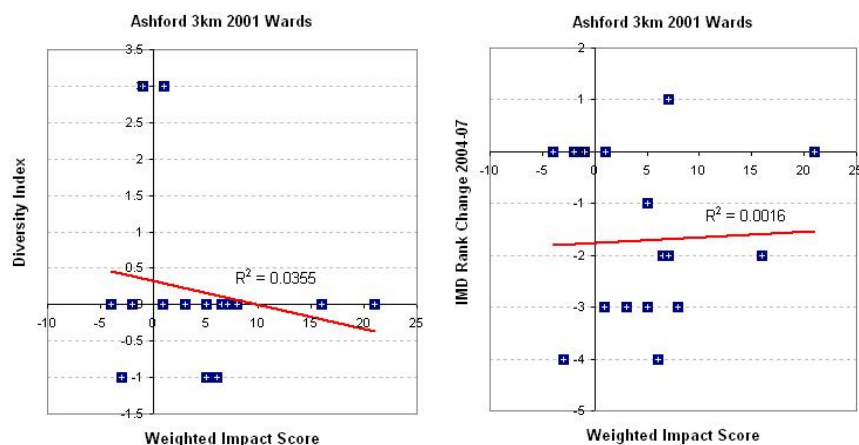


Fig. 10.73 & 10.74: Demographic Diversity and IMD rank change vs. the impact score

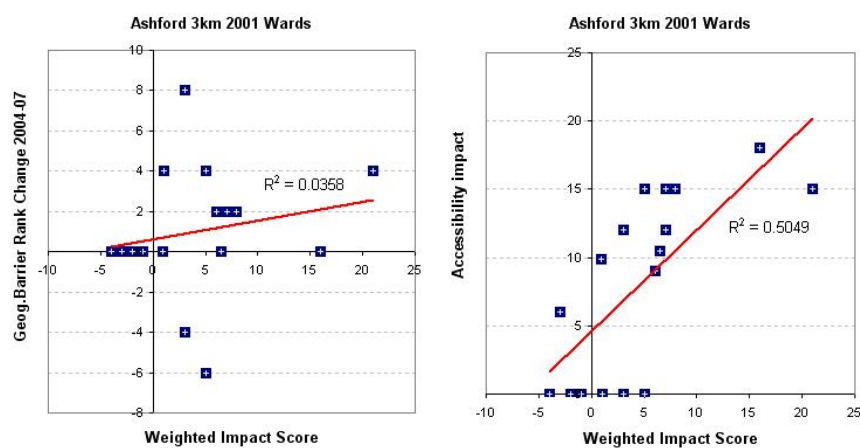


Fig. 10.75 & 10.76: Geographical Barriers rank change and Accessibility vs. the impact score

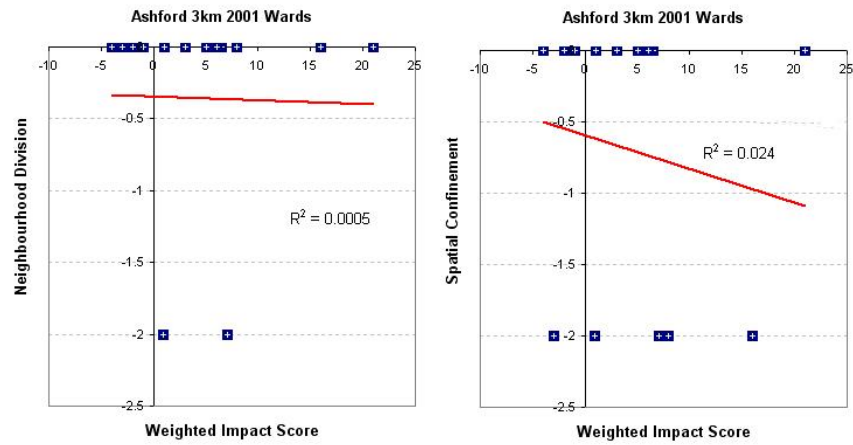


Fig. 10.77 & 10.78: Neighbourhood Division and Spatial Confinement vs. the impact score

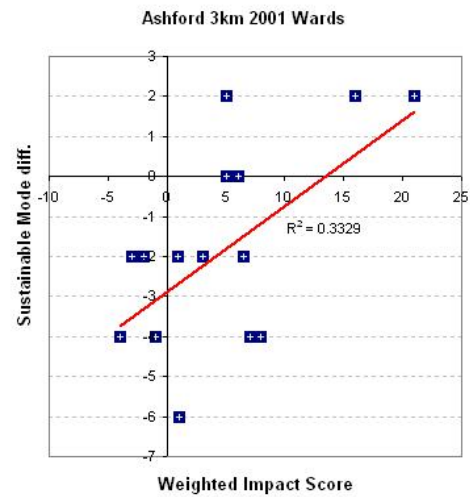


Fig. 10.79: Sustainable mode use change vs. the impact score

10.18

Appendix:

Radar graphs for Ashford wards: all variables

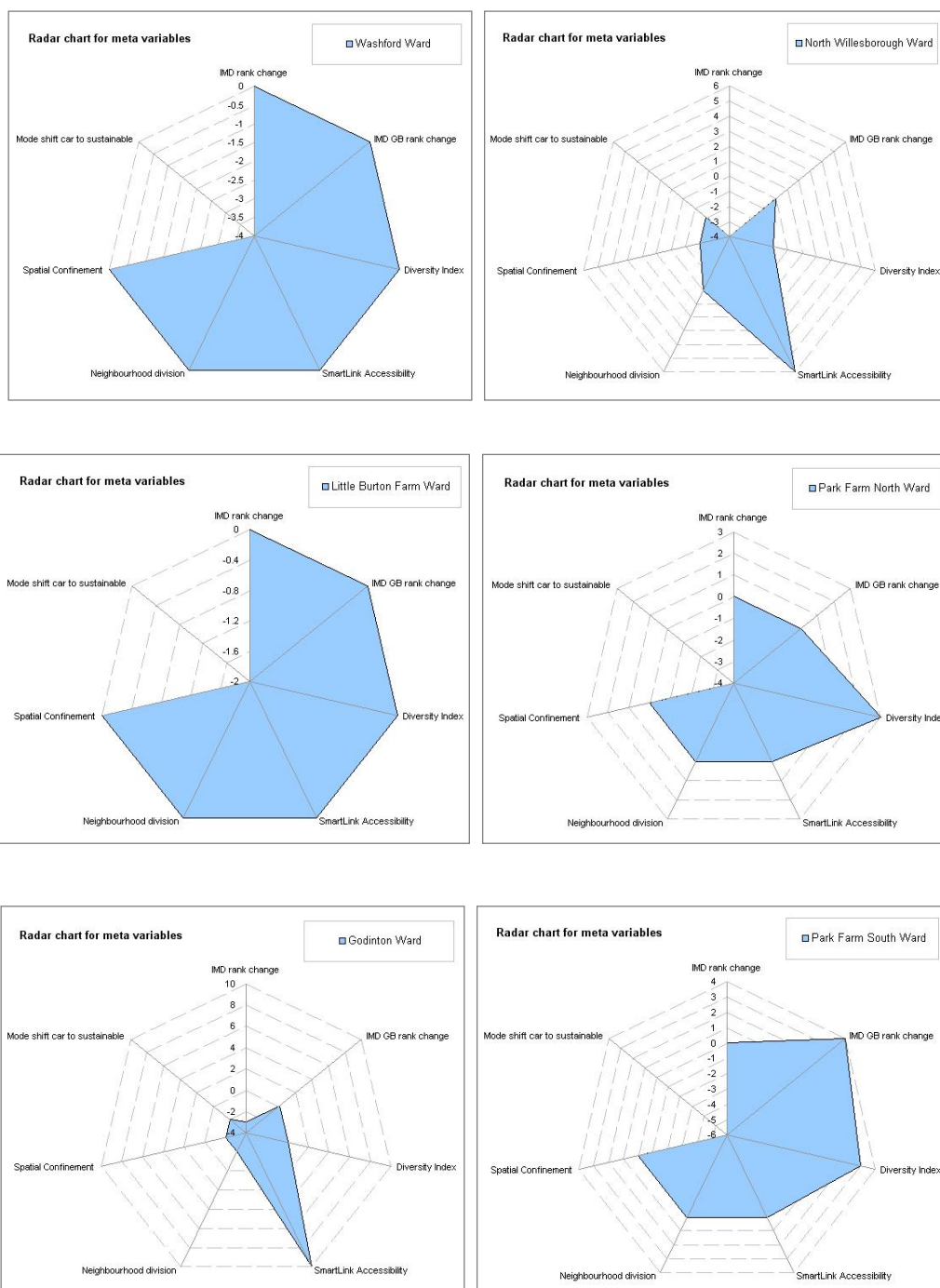


Fig. 10.80 - 10.85: Radar charts for Washford, N Willersborough, Little Burton Farm, Park Farm North Godinton and Park Farm South wards

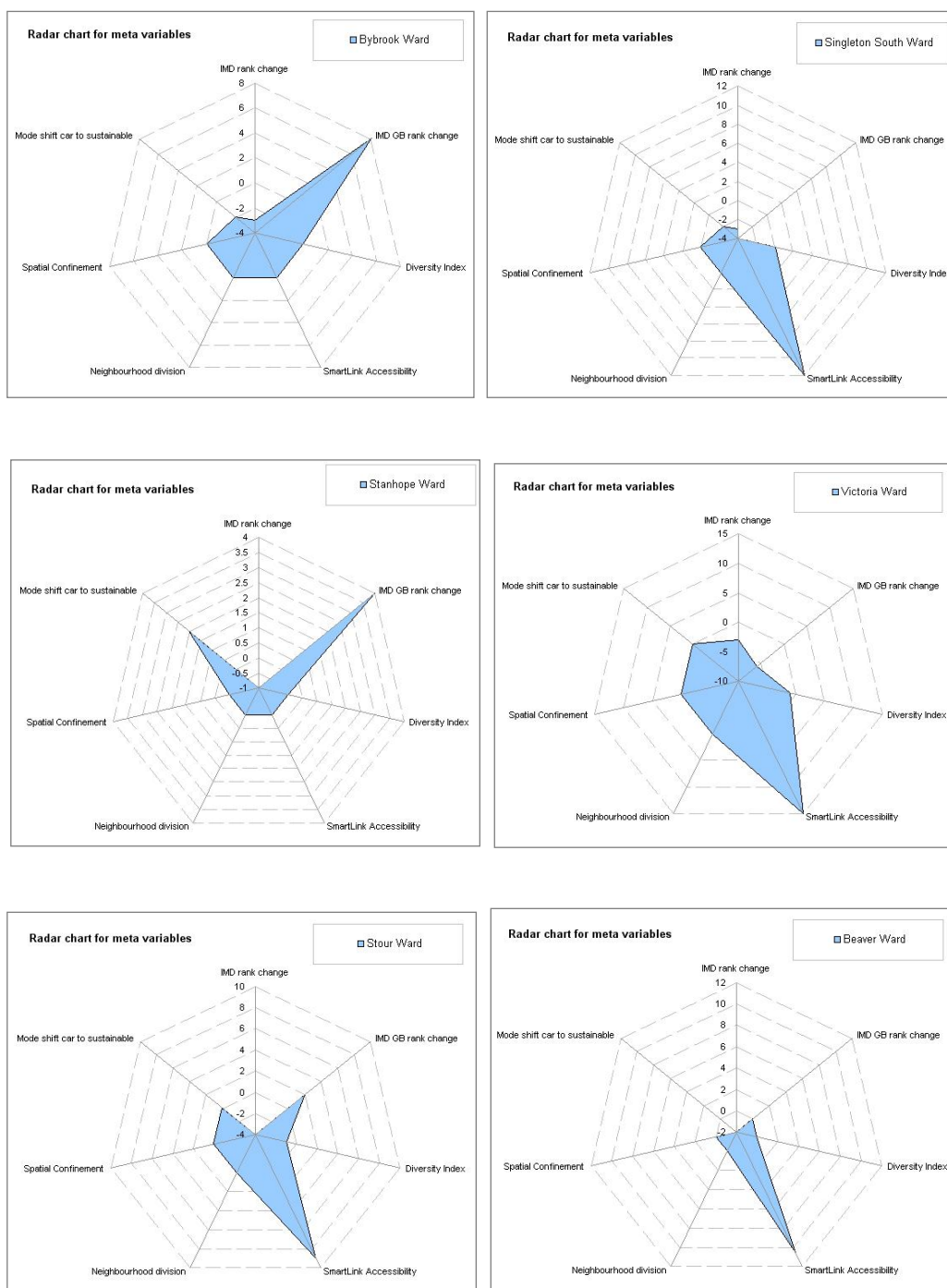


Fig. 10.86- 10.91: Radar charts for Bybrook, Singleton South, Stanhope, Victoria, Stour and Beaver wards

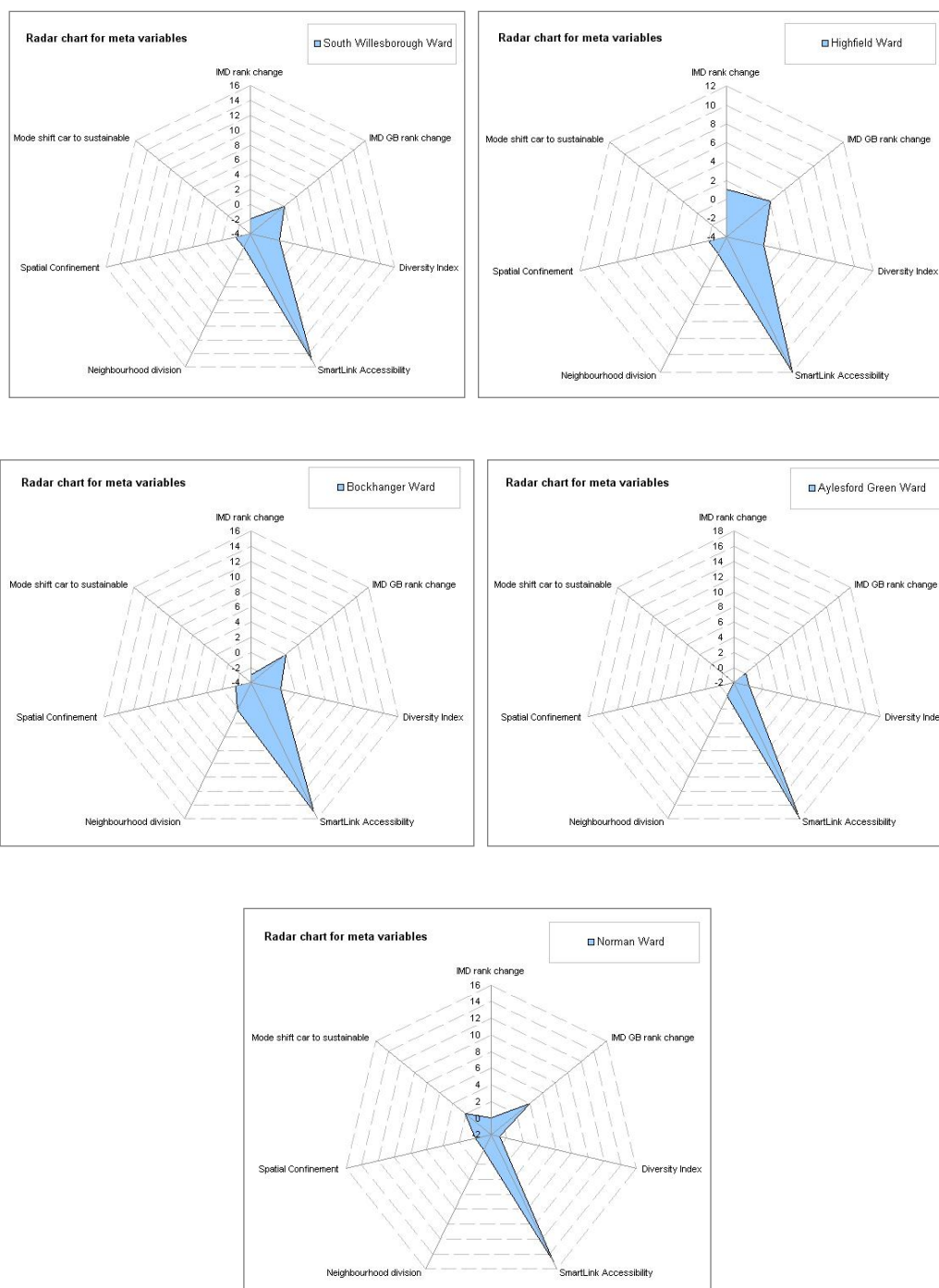


Fig. 10.92 - 10.96: Radar charts for S. Willesborough, Highfield, Bockhanger, Aylesford Green and Norman wards

10.19

Appendix:

Scatterplot graphs for Ebbsfleet wards

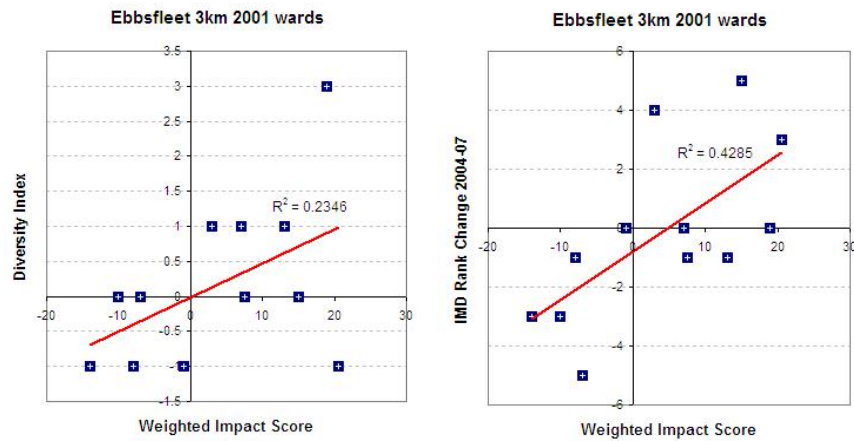


Fig. 10.97 & 10.98: Demographic Diversity and IMD rank change vs. the impact score

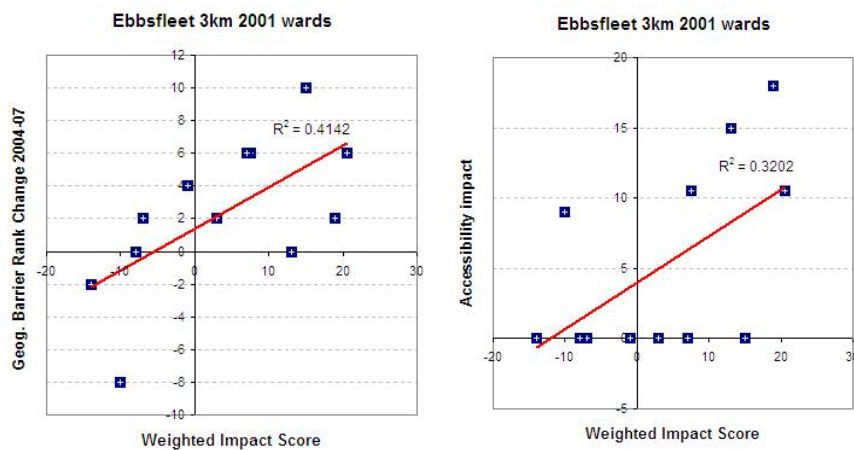


Fig. 10.99 & 10.100: Geographical Barriers rank change and Accessibility vs. the impact score

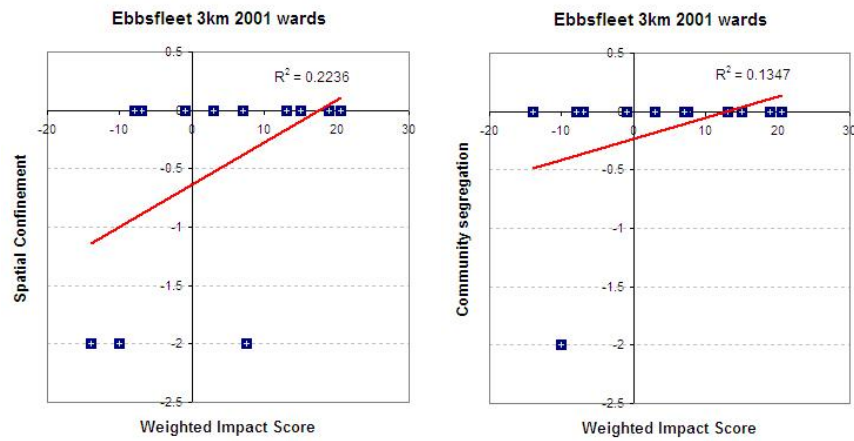


Fig. 10.101 & 10.102: Spatial Confinement and Community Segregation vs. the impact score

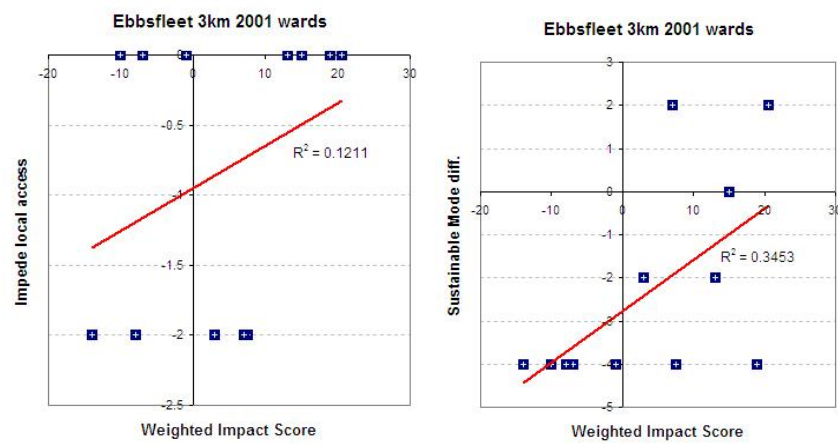


Fig. 10.103 & 10.104: Impeded Access and Sustainable Mode use vs. the impact score

10.20

Appendix:

Radar graphs for Ebbsfleet wards: all variables

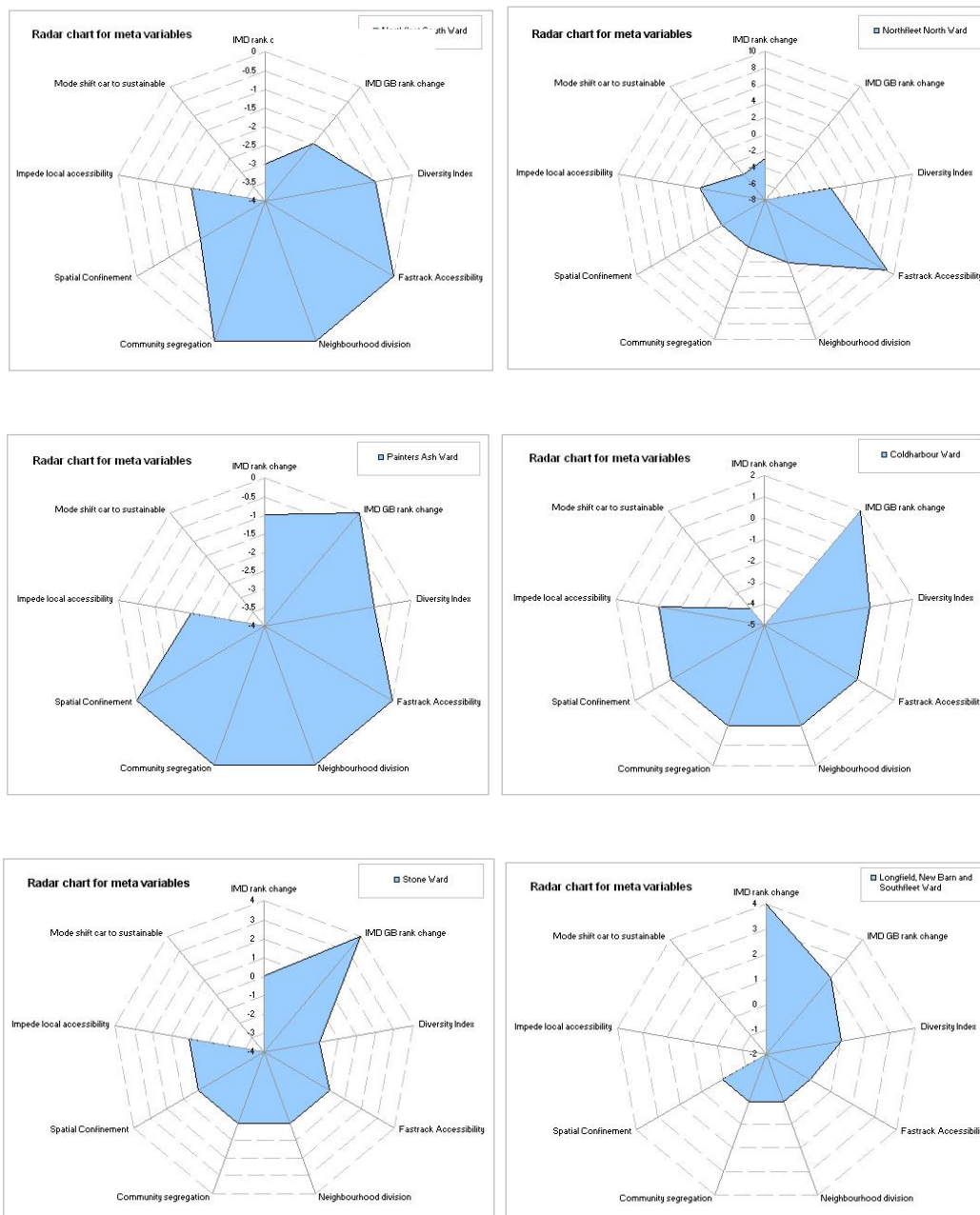


Fig. 10.105-10.110: Radar charts for Northfleet South and Northfleet North, Painters Ash, Coldharbour Stone, and Longfield wards

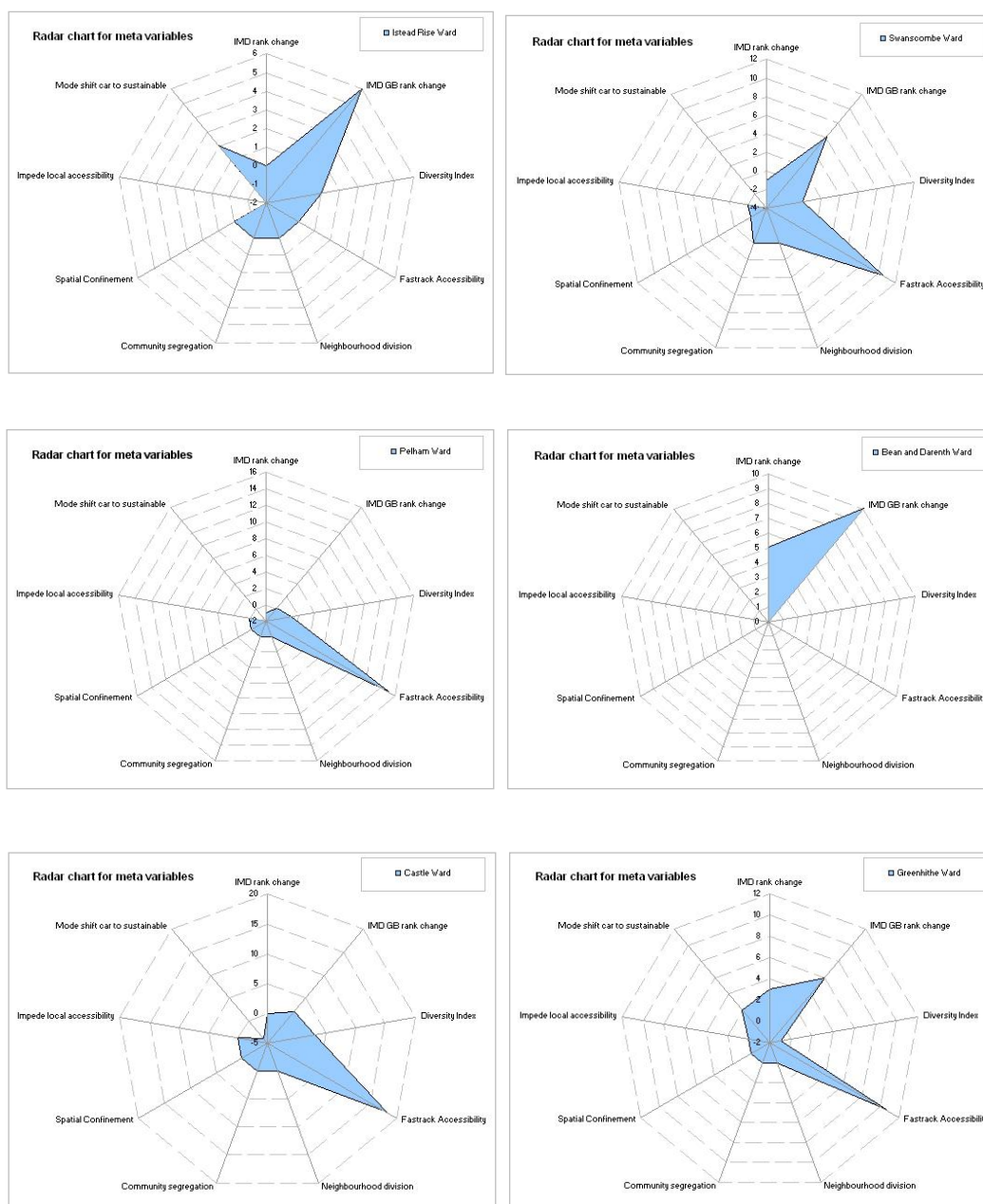


Fig. 10.111 - 10.116: Radar charts Istead, Swanscombe, Pelham, Bean Castle and Greenhithe wards

10.21**Appendix:****Rationale for the National Indicator Sets**

The detailed rationale behind the indicators chosen for the community cohesion meta score (below) is taken from the Audit Commission FAQs regarding the datasets (Audit Commission 2009):

The specific indicators in this study are the proportion of the adult population who say they 'tend to agree', or definitely agree' that ...

NI 1 - their local area is a place where people from different backgrounds get on well together in their local area:

Rationale: The Local Government White Paper sets out Government's aim of creating strong and cohesive communities and thriving places in which a fear of difference is replaced by a shared set of values and a shared sense of purpose and belonging. The aim in doing so is to ensure that the economic and cultural benefits of diversity are experienced by everyone in each community, recognising that this means promoting similar life opportunities for all. This particular measure is widely recognised as a key indicator of a cohesive society, shown to measure a number of strands of the community cohesion definition. The question that feeds this indicator was previously used in the 2006/7 BVPI satisfaction survey.

NI 2 – they feel that they belong to their neighbourhood

Rationale: The Local Government White Paper sets out Government's aim of creating strong and cohesive communities and thriving places in which a fear of difference is replaced by a shared set of values and a shared sense of purpose and belonging. A sense of belonging to one's neighbourhood is therefore a key indicator of a cohesive society. The question that feeds this indicator was previously used in the Citizenship survey.

NI 3 - they take part in civic participation in the local area

Rationale: To promote greater local participation in a range of civic activities. Civic participation is one of the principal means by which individuals exercise their empowerment for the benefit of the locality, often at the same time increasing their own level of empowerment. Contributing to a decision making group requires a degree of personal confidence combined with a willingness to be a conduit for wishes and needs of other residents. An increase in the number and diversity of

people taking on such roles can help to create fairer, more inclusive policies whilst spreading the perception that public decision making is accessible to the influence of all legitimate interests. It can help to make civic institutions more representative of and accountable to the local population. It can also contribute to concentrating local decision making more effectively on the issues all members of society believe are important, as well as strengthening ties between such bodies and the people they serve, so building trust.

Local authorities are encouraged to consider this indicator in terms of narrowing gaps between different groups in order to raise involvement of disadvantaged sections of society. Disadvantaged groups may include women, people from an ethnic or religious minority, disabled people, young people, older people, and lesbian, gay, bisexual and transsexual people. For example, there are disproportionately low numbers of black and minority ethnic women councillors, disabled school governors and ethnic minority magistrates. Targeting this indicator on a specific group(s) should be a way to make progress in addressing such inequalities. The question that feeds this indicator was previously used in the citizenship survey

NI 5 - they feel overall/general satisfaction with local area

Rationale: The Government recognises that the quality of place remains a priority to residents and drives how satisfied people are with their local area as a place to live. This indicator will provide authorities and service deliverers with a baseline of local satisfaction, which will help them, identify and address the sorts of issues affecting how residents feel about their local area. The question that feeds this indicator was previously used in the 2006/7 BVPI satisfaction survey.

NI 23 - they perceive that people in the area treat one another with respect and consideration

Rationale: To encourage local authorities and their partners to take action to promote strong communities with shared values where community members treat one another with respect and consideration. The question that feeds this indicator was previously used in the 2006/7 BVPI satisfaction survey and the British Crime Survey (BCS).

10.22

Appendix:

Calculations: MSOA population turnover data for Ebbsfleet

Population Turnover per 1000 residents for Ebbsfleet 3km MSOAs mid-2006 - mid-2009 (ONS / NeSS)												
		2006-07	2007-08	2008-09	Std Dev	Score		Kent (regional) means		2006-07	2007-08	2008-09
Dartford 002	Inflow	110	125	126	0.5 -1.5	-1			Inflow	90	84	93
	Outflow	85	90	100	-0.5-0.5	0			Outflow	86	80	90
	Turnover	195	215	226	0.5 -1.5	-1			Turnover	176	165	184
Dartford 004		2006-07	2007-08	2008-09				SE England GOR means		2006-07	2007-08	2008-09
	Inflow	86	87	95	-0.5-0.5	0			Inflow	93	86	94
	Outflow	74	75	83	-0.5-0.5	0			Outflow	90	83	92
	Turnover	160	162	178	-0.5-0.5	0			Turnover	184	169	186
Dartford 006		2006-07	2007-08	2008-09				Calculated from all Kent MSOAs together				
	Inflow	76	87	85	-0.5-0.5	0		Kent MSOA 3yr mean	89.1	86.1	175.2	
	Outflow	68	92	83	-0.5-0.5	0		1 STD DEV	27.7	29.7	56.1	
	Turnover	174	179	168	-0.5-0.5	0		0.5 Std Dev	13.8	14.8	28.0	
Dartford 008		2006-07	2007-08	2008-09				Std Dev range	Inflow	Outflow	Turnover	
	Inflow	87	70	77	-0.5-0.5	0		(Higher than avg) 2.5	158.3	160.2	315.4	
	Outflow	81	67	73	-0.5-0.5	0		1.5	130.7	130.6	259.3	
	Turnover	168	137	150	-0.5-0.5	0		(Average Turnover)	0.5	103.0	100.9	203.3
								-0.5	75.3	71.3	147.2	
Dartford 012		2006-07	2007-08	2008-09				-1.5	47.6	41.6	91.2	
	Inflow	73	70	73	-1.5 - -0.5	1		(Lower than avg) -2.5	20.0	12.0	35.1	
	Outflow	81	64	72	-1.5 - -0.5	1						
	Turnover	154	134	145	-1.5 - -0.5	1						
Dartford 013		2006-07	2007-08	2008-09				Cohesion Score				
	Inflow	69	60	65	-1.5 - -0.5	1		>2.5	-3			
	Outflow	60	56	56	-1.5 - -0.5	1		1.5-2.5	-2			
	Turnover	129	116	121	-1.5 - -0.5	1		0.5-1.5	-1			
								-0.5 - 0.5	0			
Gravesham 001		2006-07	2007-08	2008-09				-1.5 - -0.5	1			
	Inflow	105	96	104	0.5-1.5	-1		-2.5 - -1.5	2			
	Outflow	114	106	156	1.5-2.5	-2		<-2.5	3			
	Turnover	219	202	230	0.5-1.5	-1						
Gravesham 002		2006-07	2007-08	2008-09								
	Inflow	126	114	139	1.5-2.5	-2						
	Outflow	126	121	155	1.5-2.5	-2						
	Turnover	252	235	294	1.5-2.5	-2						
Gravesham 004		2006-07	2007-08	2008-09								
	Inflow	80	76	91	-0.5-0.5	0						
	Outflow	93	86	80	-0.5-0.5	0						
	Turnover	173	162	171	-0.5-0.5	0						
Gravesham 006		2006-07	2007-08	2008-09								
	Inflow	76	68	78	-0.5-0.5	0						
	Outflow	65	61	59	-1.5 - -0.5	1						
	Turnover	141	129	137	-1.5 - -0.5	1						
Gravesham 009		2006-07	2007-08	2008-09								
	Inflow	65	63	60	-1.5 - -0.5	1						
	Outflow	63	55	52	-1.5 - -0.5	1						
	Turnover	128	118	112	-1.5 - -0.5	1						
Gravesham 012		2006-07	2007-08	2008-09								
	Inflow	62	55	59	-1.5 - -0.5	1						
	Outflow	49	58	51	-1.5 - -0.5	1						
	Turnover	111	113	111	-1.5 - -0.5	1						

10.23

Appendix:

Community Cohesion scores from Quality of Life indicators

Calculations for the standard deviation from the Kent mean for community cohesion scores for Ashford and Ebbsfleet Quality of Life indicators

NI	Kent mean	-2.5	-1.5	-0.5	0.5	1.5	2.5
1	75.8	65.1	69.4	73.7	77.9	82.2	86.5
2	58.7	50.0	53.5	57.0	60.5	64.0	67.5
3	12.5	7.2	9.3	11.4	13.6	15.7	17.8
5	80.2	64.5	70.8	77.1	83.3	89.6	95.9
23	32.3	15.4	22.2	28.9	35.7	42.4	49.2

NI	Dartford mean	Std. Dev.	CC Score	NI	Gravesham mean	Std. Dev.	CC Score
1	71.2	-1.5 - -0.5	-1	1	74.3	-0.5 - 0.5	0
2	52.8	-2.5 - -1.5	-2	2	57.2	-0.5 - 0.5	0
3	9.1	-2.5 - -1.5	-2	3	15.7	1.5	1
5	71.8	-1.5 - -0.5	-1	5	72.3	-1.5 - -0.5	-1
23	40.2	0.5 - 1.5	1	23	39.9	0.5 - 1.5	1

Fig. 10.117 National Indicators (NIs) relating to Community Cohesion (CC): standard deviations

10.24

Appendix:

Calculations: IMD Income Domain

Ebosfleet 2001 Ward Name	IMD Income 2007 Std Dev from 10km mean					IMD Income domain rank change 2004-07					WardScore
	-2	-1	0	1	2	-2	-1	0	1	2	
Stone		2	2					3	1		1
Castle				1				1			0
Greenhithe		1		2				1	1	1	3
Swanscombe		3	1				1	1	2		1
Northfleet North	2	1	1			1	1	2			-3
Pelham		3	1				2	1	1		-1
Bean		1	2	1				1	3		3
Longfield				3	1			1	3		3
Istead					2			2			0
Painters		1	1	2			1	2			-1
Coldharbour		3					3	1			-3
Northfleet South		2	3			1	2	1	1		-3

10.25

Appendix:

Calculations: Jobseekers Allowance claimants

Ebbfleet	JSA / Unemployment: Std Dev from 10km mean						WardScore
Ward Name	-3	-2	-1	0	1	2	
Stone			1	3			-1
Castle				1			0
Greenhithe				3			0
Swanscombe			3	1			-3
Northfleet North	1	1		2			-5
Pelham		2	1	1			-5
Bean			1	2	1		0
Longfield				1	3		3
Istead				2			0
Painters				3			0
Coldharbour		1		3			-2
Northfleet South			1	4			-1

10.26

Appendix:

CTRL questionnaire for Pre-Hypothesis Research

Conducting the Pre-Hypotheses Interviews: crib-sheet [from Cognitive Edge Pty. 2006]

- Introduce self (naïve to the topic), and OMEGA Centre
- Aim of the interview is to elicit their **experiences around the CTRL project to support a broader study by OMEGA Centre on Mega projects**:

This project critically examines thirty international experiences with ten worldwide university partners to collaborate on the research in the planning, appraisal and evaluation of Mega Urban Transport Projects (MUTPs) and their impacts in the Developed World. Its overall aim is to ascertain what constitutes a 'successful project' in the context of our fast changing world where visions of sustainable development are increasingly coming to the fore as a basis for assessing future development.

Two strands of research: **hypothesis-led** [*Deductive*: Commonly a statement or theory whose truth or falsity is known in advance of experience or observation (a priori), referring to instances of reasoning in which conclusion follows the premises] And **pre-hypothesis** [*inductive*: statement or theory whose truth or falsity is made more probable by the accumulation of confirming evidence (based on experience) referring to instances of reasoning in which statements are made about a phenomenon based on obs of that phenomenon.)

- Ask for **permission to record their experiences**. Explain that it's essential we capture their experiences verbatim (so we don't bias the results by writing a summary).
- Re-assure that the experiences they share will be **confidential**. Summary results and conclusions will be published but not with attribution to a specific source.

Show them the **timeline for the interview** and explain that we're looking for *anecdotal* experiences:

- Detailed accounts of real events and ask them if possible to refrain from statements or opinions that aren't followed up with anecdotal illustrations. Ideally you'd like 3-4 anecdotes, so they'll need to keep them to 5 minutes or so and in that time be as descriptive and as illustrative as possible.

An anecdote has a few simple characteristics:-

- It conveys a genuine account of someone's experience
- It is usually centred around an event
- It is told from someone's perspective

Ask them to be clear about when they're talking about their actions verses those of others

RECORDING:

- Switch on the recorder.
- Add the **date**,
- **the time of the interview**
- **and interviewees name** and relationship to the CTRL.

A) Their relationship to the project

“What is your relationship to the CTRL? Please explain which aspect of the project you were responsible for, involved in or affected by.”

B) Timeline of events **DRAW ON LARGE PAPER: MARK ON**

Question 1: “Looking back, what in your mind were the most pivotal events that shaped the CTRL? (Turning points or triggers of significance, not necessarily project milestones)

Ask them to describe in detail:

1. what happened,
2. who was involved,
3. what the outcome was,
4. which problems were encountered,
5. solutions devised,
6. what lessons they learnt,
7. what they felt,
8. what was said

Please consider

9. which of these were most surprising?
10. which of these were most predictable?
11. which of these were planned?
12. which were unexpected?

Specify the date the event occurred,

1. who were the main people involved,
2. where it took place and
3. why it took place

C1) Anecdotal Experiences (4)

An anecdote has a few simple characteristics:-

- It conveys a genuine account of someone's experience
- It is usually centred around an event
- It is told from someone's perspective

Looking for root causes of issues (up to interviewee what issues), how problem occurred, impact for future lessons for decision makers to learn from, in order to deliver more successful MUTPs in the future,

- Provide the interviewee with **list of all 13 prompting questions** (except Q.1).
- Select **three-four** that they're comfortable answering, **esp. question 9 last**
- Start by asking them the first prompting question. Ask them to keep to 5 minutes to describe their experience. **Clarify** anything confusing

C2) and *probing questions*: "Give me an example"

1. what was your role? (clarify if necessary.)
2. What instigated change in that idea?
3. what tasks were you leading on? (you – personally? Organisation?)
4. what happened when X was announced / changed / lost etc
5. how did things change for you afterwards?
6. can you describe how / why is X significant in your experience?
7. what happened to make you think that?
8. what happened then? Should we consider this significant? For whom?
9. what other factors may have been instrumental?
10. tell me more about that problem/decision/solution/situation you described
11. what were you thinking, feeling, and doing at the time?
12. who else was involved, what were they doing, saying? How were you interacting with them
13. what was the outcome of the story? What happened next as a result?
14. what did you learn from that experience?
15. what would you do differently next time?
16. if a friend found themselves in that same position, what advice would you give them?
17. how did the problem impact the stakeholders involved?
18. what was exceptional about the success you experienced? Why do you think it was successful? Who or what helped make that happen?
19. share with me exactly what was said/done by the parties involved.
20. who would be responsible for making that successful future happen?

D) Explain follow up:

- Typing up the transcripts asap
- Will post to them (via email) ask to confirm that they're happy with what we have
- Will ask to index (via some tick boxes and scale bars) each anecdote
- Re-send asap

E) Do they have 'Sense Making Items'?

An artefact that helps us better understand why those experiences were so important to them e.g.: meeting agendas, web-links, videos, images / photographs

F) Ask for other stakeholders and further participation

Anyone else they recommend for us to talk to?

Appendix bibliography

- Audit Commission (2009) National Indicator Set (NIS) [online]<www.audit-commission.gov.uk/localgov/audit/nis/pages/default.aspx> [Accessed Sept. 2010].
- Barker, K. (2004) Barker Review of Housing Supply. London, HM Treasury.
- Barker, K. (2006) Barker Review of Land Use Planning. London, HM Treasury.
- Butcher, L., Codd, F. & Harker, R. (2010) Transport policy in 2010: a rough guide [Research Paper 10/28]. London, House of Commons Library.
- Couch, C., Sykes, O. & Borstinghaus, W. (2011) Thirty years of urban regeneration in Britain, Germany and France: The importance of context and path dependency *Progress in Planning*, 75, 1-52.
- D.C.L.G. (2007) Planning for a Sustainable Future. White Paper [Cm7120]. London, Department for Communities and Local Government. Department for the Environment, Food and Rural Affairs. Department of Trade and Industry. Department for Transport.
- D.C.L.G. (2011) Draft National Planning Policy Framework. London, Department for Communities and Local Government.
- D.E.T.R. (1998) A New Deal for Transport, Better for Everyone. White Paper. London, Department for the Environment, Transport and the Regions.
- D.F.T. (2000) Transport Ten Year Plan 2000. London, Department for Transport.
- D.F.T. (2004a) The Future of Rail - White Paper CM 6233. London, Department for Transport
- D.F.T. (2004b) The Future of Transport. London, Department for Transport.
- D.F.T. (2008) Local Transport Act 2008: an overview
[<http://www.dft.gov.uk/topics/legislation/local-transport-act/>] Accessed July 2011.
- Duckenfield, T. (2009) Transport Needs Index. Steer Davies Gleave
[<http://areaclassification.org.uk/2000/01/01/files/2009/04/transport.pdf>] Accessed Nov 2010].
- Eddington, R. (2006) Transport Study. London, Department for Transport.
- Jenkins, S. (2011) This localism bill will sacrifice our countryside to market forces. *Guardian* [Friday 29th July 2011 pg:35]. London.
- Lyons, G., Chatterjee, K. & Marsden, G. (1999) Transport visions: a young professional's perspective. *Traffic Engineering and Control*, 40, 578-92.
- O.D.P.M. (2003) Sustainable Communities: Building for the Future. London, Office of the Deputy Prime Minister.
- O.N.S. (2009) Output Area: Cluster Summaries [online]
<http://www.statistics.gov.uk/about/methodology_by_theme/area_classification/oa/cluster_summaries.asp> [Accessed December 2010].
- R.T.P.I. (2008) The Planning Act 2008: A Summary and response. London,
[<http://www.rtpi.org.uk/cgi-bin/item.cgi?id=1423>] Last accessed July 2011.
- R.T.P.I. (2011) Localism Bill: RTPi briefings to Government
[<http://www.rtpi.org.uk/item/3741&ap=1#Pre-publication%20of%20the%20Bill>] Last accessed July 2011. London, RTPi.
- Stern, N. (2006) Stern Review: The Economics of Climate Change. London, HM Treasury.
- Terry, F. (2009) The History and Background of the Planning, Policy and Funding Frameworks of Mega Urban Transport Projects in the United Kingdom [Working Paper 1.9]. London, OMEGA Centre Working Paper series, Bartlett, UCL.
- White, P. (2002) *Public Transport: Its planning, management and operation (4th Ed)*, London, Spon.
- Williams, S. & Botterill, A. (2006) Profiling Areas using the Output Area Classification. *Regional Trends*, 32, 11-19.